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SCRIPT FADING AS A PROCEDURE FOR TEACHING UNSCRIPTED LANGUAGE TO CHILDREN WITH AUTISM

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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Abstract

SCRIPT FADING AS A PROCEDURE FOR TEACHING

UNSCRIPTED LANGUAGE TO CHILDREN WITH AUTISM

by

John L. Brown

Adviser: Professor Claire L. Poulson

Script fading was used as a language instruction technique to promote conversational speech among individuals with autism during simulated shopping trips and during visits to community stores. Using a multiple-baseline-across-settings experimental design, the effectiveness of script fading was examined for three youths with autism. During pre-test trips to community stores all three youths failed to engage in any conversational interaction. Following the community pre-tests, during the response-contingent modeling phases, all three youths demonstrated near zero rates of conversational interactions. With the introduction of the script-fading procedure, all three youths successfully learned to use the scripted statements in conversations during a series of simulated shopping trips. As the scripts were faded, from last word to first word, rates of unscripted statements systematically increased. All three participants also demonstrated generalization of their newly acquired conversation skills to untrained stimuli. In addition, all three youths demonstrated generalization of their conversation skills during community shopping trips to local retail stores. The script-fading procedure enabled youths with autism to engage in appropriate conversation, during shopping trips, that was under the control of environmental, as opposed to teacher-controlled stimuli.

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SCRIPT FADING AS A PROCEDURE FOR TEACHING UNSCRIPTED LANGUAGE TO CHILDREN WITH AUTISM

by

JOHN L. BROWN

Autism is a pervasive developmental disorder that affects as many as 1 in 500 children (Gillberg, 1997). One of the defining characteristics of autism is a severe deficit in language and communication abilities (American Psychiatric Association, 2000). As many as 50% of individuals with autism have no functional speech (Charlop & Haymes, 1994). Behavior analytic intervention strategies have proven exceptionally effective in teaching a variety of language skills to individuals with autism (Lovaas, 1977). Language skills such as generalized verbal imitation (Young, Krantz, McClannahan, & Poulson, 1994), labeling nouns (Lovaas, 1977), using adjectives (Rousseau, Krantz, Poulson, Kitson, et al, 1994), making social initiations (Krantz & McClannahan, 1998), and engaging in conversation (Stevenson, Krantz, & McClannahan, 2000; Sarokoff, Taylor, & Poulson, 2001) have successfully been taught using behavior analytic technology. These studies represent an impressive body of research-based language instruction procedures for individuals with autism. The focus of other behavior analytic language studies has shifted from the acquisition of basic language skills to instruction that promotes the use of language skills across a variety of environments (Krantz & McClannahan, 1993). These studies represent a shift from skill acquisition to stimulus control.

The acquisition of basic language skills and the variables that control the emission of those skills are two aspects of language instruction that exactly parallel the two effects of operant reinforcement. When an operant is reinforced, there are two effects of that reinforcement operation. The future probability of the operant increases and the stimulus conditions present during the operant acquire a discriminative stimulus function such that the future probability of emission of that operant increases in the presence of those conditions (Rilling, 1977). That is to say, basic learning theory acknowledges a dual function of reinforcement operations. Reinforcement both strengthens the response it follows and strengthens the control over that response by salient environmental stimuli.

Operant language instruction for individuals with autism proceeds along a general developmental course that includes such skills as imitating phonemes, imitating words, imitating sentences, answering questions, asking questions, and engaging in conversation. Many of these skills are taught using discrete-trial teaching procedures. During discrete-trial teaching, an instructor presents teaching trials by first presenting a discriminative stimulus, then waiting for the learner to respond, and finally presenting reinforcing stimuli contingent on correct responses. If the learner fails to respond or responds incorrectly the instructor may use a variety of prompting strategies to assist the learner to make a correct response. For example, if a student were taught to label nouns, a series of trials would typically be presented by having the student sit in a chair in front of the instructor. During each trial the instructor would hold up a toy and ask the student to label the item. The student would receive reinforcement for correct answers. If the

student gave an incorrect answer or did not answer the instructor would typically provide a prompt to help the student give the correct answer (Lovaas, 1981).

Discrete-trial language instruction has proven to be extremely effective in helping students with autism gain basic language skills (Lovaas, 1977). Several authors have noted that discrete-trial teaching procedures are not especially effective at teaching skills that readily generalize to less-structured settings (Carr & Kologinsky, 1983; Oliver & Halle, 1982). These failures of generalization can be understood as inappropriate stimulus control resulting from the function of reinforcement during discrete-trial teaching. Reinforcement serves to increase the probability of correct answers during discrete-trial teaching, however, it also allows the discrete-trial teaching situation to gain stimulus control over those newly learned language responses. More specifically, as teaching progresses the stimuli in the teaching situation acquire an S^+ function while extra-teaching stimuli acquire an S^- function. When we later ask a child to exhibit those language skills outside of the discrete-trial teaching situation we often find that the S^- function of the extra-teaching stimuli, present in the generalization setting, interferes with the emission of those skills in more naturalistic settings.

The dual function of reinforcement presents a paradox for language instruction in autism. The rigid format of discrete-trial teaching provides the necessary structure for individuals with autism to succeed in learning language skills. At the same time discrete-trial teaching may build very narrow stimulus control that fails to promote generalization of language skills to other environments.

Behavior analytic researchers have examined the processes and conditions that serve to promote generalization (Stokes & Baer, 1977). Many studies have examined the generalization of language skills among individuals with autism (e.g., Koegel, Camarata, Valdez-Menchaca, & Koegel, 1998; Krantz & McClannahan, 1998; Matson, Sevin, Fridley, & Love, 1990). Many of these authors use the term spontaneous to describe language performances that occur in natural environments. Spontaneity is often viewed, in the developmental literature, as behavior that has its cause within the individual emitting the behavior. In fact, the lack of spontaneity is sometimes seen as a result of behavior-analytic teaching procedures (Zanolli, 1997).

In common usage, 'spontaneous' typically refers to performances that occur without apparent external cause. Sigafoos and Reichle (1993) provide a more behavior analytic conceptualization of spontaneity that is directly applicable to language use in natural settings. They suggest that language that is considered spontaneous refers to linguistic responses that occur in the absence of an explicit prompt such as a model to be imitated or a question asked by an instructor. They argue that spontaneous performances are those performances under the control of discriminative stimuli that occur in the natural environment as opposed discriminative stimuli presented or controlled by an instructor. Spontaneous language, according to these authors, can be viewed as a continuum with the least spontaneous language being prompted by an instructor and the most spontaneous performances being under the discriminative control of interoceptive and/or naturally occurring environmental stimuli. By defining spontaneity in stimulus

control terms, Sigafoos and Reichle bring spontaneous language well within the realm of behavior analytic investigation.

Individuals with autism, even those who have received intensive language intervention, are often viewed as lacking spontaneous language (Carr & Kologinsky, 1983; Oliver & Halle, 1982). Several studies have examined spontaneous language among individuals with autism using naturalistic-observation research methodologies. Stone and Caro-Martinez (1990) examined the spontaneous communication of a group of children with autism. They defined spontaneous communication as communicative acts that were initiated by the child. Using school-based observations they found spontaneous communication occurred rarely. They also found a significant relationship between the severity of autism and the number of spontaneous speech episodes. Students with more severe autism exhibited fewer spontaneous speech episodes. Although this study shows that the severity of autism is related to reduced levels of speech, it does not present any normative comparison data.

Hauck, Fein, Waterhouse, and Feinstein (1995) compared the unprompted interactions of children with autism to the interactions of children with mental retardation in typical school environments. Observers recorded a variety of verbal and non-verbal initiations among the children in the school setting. Initiations included interactions such as imitating other children's actions, looking at another child, verbally greeting another child, and verbally requesting assistance. They found that children with autism initiated almost 50% less often than children with mental retardation did. This study did not differentiate verbal and non-verbal initiations and therefore it is impossible to tell to what

extent non-verbal initiations are responsible for the observed differences. The low level of initiations observed among the children with autism, however, is consistent with clinical observations that report severe deficits in the use of spontaneous language.

Clearly these studies have established that there are spontaneous language deficiencies among individuals with autism. How, then, does one help an individual who has learned some basic language skills using discrete-trial teaching to develop the more complex and distal stimulus control that will promote spontaneous language? A number of studies have examined procedures that reduce prompt dependence and promote spontaneous language. It may be possible to teach spontaneous use of basic language skills directly after discrete-trial teaching. It seems more plausible, however, that a sequence of instructional strategies based on a continuum of stimulus control will be more effective in facilitating the development of spontaneous language. The following summary of research studies will use this stimulus-control continuum as an organizing principle to examine behavior analytic literature that promotes spontaneous language.

Charlop, Schreibman, and Thibodeau (1985) conducted a study in which they taught children with autism to request preferred items when presented by an instructor. They used a time-delay teaching procedure. In this procedure, a preferred item was presented by the instructor and after a varying delay the instructor modeled a request for the item. During initial teaching, a zero delay was used such that the instructor modeled the request concurrently with presenting the stimulus. As the children began imitating the instructor's model the delay between stimulus presentation and the instructor's model was systematically increased in 2-s increments until the children were responding before

the presentation of the instructor's model. This study successfully taught children with autism to request preferred stimuli when those stimuli were presented by an instructor. A comparison of the likely stimulus control in this procedure and a more typical discrete-trial procedure shows the shift away from verbally prompted language. In a typical discrete-trial procedure the learner is presented with a stimulus and then the instructor asks: "What is this?" Thus, it is possible that the stimulus controlling the learner's response is the instructor's verbal behavior. In the procedure used by Charlop, Schreibman, and Thibodeau, during the terminal phase, the instructor presents no verbal stimuli. In this case the stimuli setting the occasion for the learner's responses are more likely to be the instructor's manipulation of the objects or the appearance of the items in the learner's visual field. Although still a trial-based procedure, this study achieved a shift in stimulus control away from the instructor's verbal behavior toward more naturalistic stimuli.

Using a similar time-delay procedure Matson, Sevin, Fridley, and Love (1990) taught three children with autism to make polite statements in appropriate social situations. Like the Charlop, Schreibman, and Thibodeau (1985) study, they presented objects to children and taught them to request the objects by using utterances in the form of "[object name], please." After learning to request objects when presented by the instructor, they were taught to say "Thank you." after receiving the object. Similarly, they were taught to say "You're welcome." after responding to a request to give an object to their instructor. The stimulus conditions in place during the "Thank you." and "You're welcome." teaching sessions are similar to the conditions under which the use of polite

statements should occur in the natural environment. Although this study used a trial-based teaching procedure, polite statements are one area of speech that can be brought under appropriate stimulus control with this type of procedure.

Ingenmey and Van Houten (1991) extended the time-delay procedure to a more naturalistic play setting. During play sessions, an instructor verbally prompted the learner to engage in specific play responses (i.e., "Draw a flower." or "Park the car."). The learner was taught, using a time-delay procedure, to verbally describe his play behavior. For example, he was taught to make statements such as: "I made a flower." and "Car needs gas." Results of this study showed acquisition and generalization of the play statements to additional play responses. Although the child's verbalizations seem to be under the stimulus control of his play responses, the occurrence of the play responses is under the control of verbal prompts from the instructor.

The natural language paradigm (NLP) is a language instruction program that is conducted by presenting play sessions with opportunities for the child to engage in speech (Koegel, O'Dell, & Koegel, 1987). NLP instruction attempts to use a variety of behavior analytically developed language instruction principles in a less structured teaching session. Specifically, techniques such as modeling appropriate language, reinforcing all language use by the child, using child initiations as teaching opportunities, and adjusting the environment to promote language use are all used in an NLP intervention. Laski, Charlop, & Schreibman (1988) trained parents to implement NLP to increase verbalizations among a group of children with autism. Parents were trained to use the NLP intervention techniques through a discussion with the trainer, observations

of the trainer with their child, teaching sessions with the trainer and their child, and finally by conducting their own sessions and receiving feedback from the trainer. Results showed increased vocalizations for all children. When analysis was limited to vocalizations that were not prompted by immediate verbal stimuli, six of eight children showed increased verbalizations. These increases indicate that NLP, which includes procedures that are less structured than discrete-trial teaching, may help promote language outside of discrete-trial settings among some children with autism.

Schepis, Reid, Fitzgerald, Faw, van den Pol, and Welty (1982) examined an intervention to increase the use of manual signs in institutionalized groups of non-verbal youth with mental retardation and autism. The authors targeted manual signing for the subjects in this study because they had been largely unsuccessful in verbal language teaching programs. They used an incidental-teaching intervention to promote the subjects' use of language. Incidental teaching is an intervention that uses learner-, as opposed to teacher-initiated instructional opportunities. Incidental teaching is accomplished by arranging the environment so that preferred stimuli are placed in the environment such that the student will attempt to obtain those stimuli. When the student initiates by reaching for, gesturing toward, or obtaining an item of interest the teacher uses that opportunity to ask for a linguistic elaboration (Hart & Risley, 1975; Hart & Risley, 1980). For example, if a student tried to open a container with a preferred snack inside, the teacher could ask the student to say or sign "Open it." and then provide a bit of the snack after the student completed the elaboration.

The incidental teaching intervention used by Schepis et al. was successful in increasing the use of signing among both youth with autism and youth with mental retardation. Results indicated that only some of the individuals successfully used the target signs without elaboration requests. The authors also note that a significant level of ongoing staff intervention and environmental management was necessary to maintain signing performances.

Zanolli, Daggett, and Adams (1996) conducted a study that examined a priming intervention to increase spontaneous language initiations among children with autism. Priming is an intervention that is conducted prior to the opportunity to engage in a target activity. Priming interventions are also conducted in low demand situations using the same materials that will be used in the target activity. The tasks presented during priming are of minimal difficulty, thus providing an opportunity to complete the task successfully. A final characteristic of priming is that there is a rich schedule of reinforcement.

Zanolli and her colleagues used priming sessions consisting of having the target child practice asking a peer for preferred toys. Immediately after priming sessions, the children were returned to their regular activities and the number of unprompted initiations was measured. Results demonstrated that priming was effective at increasing the number of initiations made by children with autism. During a terminal phase of the study, the number of priming trials was reduced by half. With reduced numbers of priming trials, there was some reduction of initiations but overall the rate of initiations remained above baseline levels.

This intervention used in this study successfully pushed the students toward more environmental control of language. Specifically, during the classroom data collection sessions there were no teacher-mediated stimuli present in the environment. The priming sessions, however, represent a time-delayed prompt. The data do show some reduction in initiations when the number of priming trials was reduced. It would be important to evaluate methods of systematically removing the priming sessions while maintaining high levels of unprompted initiations.

In a similar priming study, Zanolli and Daggett (1998) examined the role of reinforcement rate during priming sessions. Using an alternating-treatments experimental design, they compared the effect of high- and low-reinforcement rates during priming sessions on speech in subsequent activities. Controlling for number of trials, they found that increased reinforcement rates during priming lead to increases in speech initiations in subsequent activity sessions. The authors also report generalization of social initiations to novel, unprimed responses. The treatment effects, however, were not maintained after the withdrawal of priming sessions.

Script fading is another strategy that has been used to increase spontaneous language. Krantz and McClannahan (1998) used a script-fading procedure to increase the social initiations of three preschoolers with autism. Script fading consists of teaching learners to use written scripts or audio recordings that provide models of appropriate language. As the learners begin to use the scripted language in their interactions, the scripted phrase or sentence is systematically faded from end to beginning. For example, if a script said "Watch me jump!" it would be faded, in four steps, to a) "Watch me," to b)

"Watch," to c) a blank script, and finally to d) no script. The Krantz and McClannahan (1998) study embedded scripts in activity schedules. The activity schedules used in this study contained pictures of 16 activities that the learners could perform without the assistance of an instructor. The learners were taught to use their activity schedules to independently retrieve the necessary materials, complete the activity, and return the materials to their storage locations (MacDuff, Krantz, & McClannahan, 1993; McClannahan & Krantz, 1997; McClannahan & Krantz, 1999). In addition, when a written script appeared in the schedule they were taught to approach a conversation partner and repeat the script. After acquiring this social initiation skill, the scripts were systematically faded from end to beginning. Upon completion of the teaching procedure, all three subjects showed high levels of social initiations although no scripts remained in their activity schedules. In addition, all three subjects showed increased use of initiations that were not scripted and initiations during new activities when they were added to the schedules. Of particular note in this study is the shift in stimulus control from teacher prompts to schedule-based prompts manipulated by the students themselves. This represents a significant step toward environmental control of speech.

In a similar study Stevenson, Krantz, and McClannahan (2000) modified script-fading technology so that it could be used with individuals with autism who could not read. They used a Language Master® audio recorder to present scripts to learners. The Language Master® machine can record and playback audio recordings up to six seconds long. They recorded scripts on the Language Master® and then used an activity schedule to prompt the learners to play the recorded scripts. After the learners learned to say the

scripts to a conversation partner, the scripts were faded by erasing words from the end of the scripts until they were fully faded. The non-reading learners in this study successfully learned to use their activity schedules as prompts to engage in social interactions with a teacher. Even non-readers were able to learn to engage in social interactions without instructor prompts using script-fading techniques.

In another script-fading study, Krantz and McClannahan (1993) taught youngsters with autism to initiate social interactions to their peers. Students were presented with written lists of scripts that they could use to initiate conversation with their peers during typical classroom activities. The youths were taught to use the written scripts to talk to their peers and then to place a checkmark next to each script that they used. As soon as the youths were correctly using the scripts, fading began. The scripts were systematically faded from end to beginning until only a single quotation mark remained. After the fading sequence was completed, all four subjects maintained high levels of social interactions. All four youths also showed increased use of unscripted language. Here again, individuals with autism were able to maintain conversational performances in the absence of scripts and prompts from instructional staff. Only the presence of their peers and their blank script pages were needed to support their newly developed conversational skills.

As the above studies show, there is a considerable literature that has, indirectly or directly, addressed the stimulus control difficulties experienced in language instruction by individuals with autism. Behavior analytic language instruction is capable of teaching basic language skills and then shifting the stimulus control of those performances toward

stimuli occurring in the natural environment. Among the most important linguistic skills is engaging in a conversation with another person. What, then, are the stimulus conditions that should set the occasion for engaging in conversation with another person? For the purposes of the current study, we assumed that two stimulus components are sufficient to set the occasion for engaging in a conversation. Specifically, we used an environment that contains both a conversation partner and an object that can serve as a topic of conversation.

The current study examined the extent to which script fading can be used as a language instruction technique to promote conversational speech among individuals with autism under stimulus control consistent with the typical environment. Script fading was selected as an instructional technique because in prior studies it has been effectively used to teach conversational speech. In addition, it requires minimal instructor prompts. It is believed that by using fading techniques it will be possible to shift control of conversational speech from scripts to the objects that serve as conversation topics. It is predicted that the introduction of a script-fading intervention will lead to increased conversational speech. In addition, the increases in conversational speech will be maintained in the absence of scripts after fading. A pilot study was conducted prior to the experiment and is reported in the Appendix.

Method

Participants

Three children with autism participated in the experiment. All three children were students at the Princeton Child Development Institute (PCDI). Each of the children was

independently diagnosed with autism by a qualified professional who was not affiliated with PCDI. All three children met the criteria for autism defined in the Diagnostic and Statistical Manual of Mental Disorders 4th ed, text revision, (American Psychiatric Association, 2000). Each of the participants could communicate using spoken language. All three children, however, had difficulty making verbal initiations to others.

Rand was 13 years old at the start of the study. He had received 10 years of educational services from PCDI. Rand scored an age equivalent of 4 years 10 months on the Peabody Picture Vocabulary Test (Dunn & Dunn, 1997) and his Vineland Adaptive Behavior Scale (Sparrow, Balla, & Cicchetti, 1984) composite score age equivalent was 4 years 0 months. Pete was 9 years old at the start of the study. He has been a student at PCDI for 6 years prior to the start of the study. Pete scored an age equivalent of 4 years 9 months on the Peabody Picture Vocabulary Test (Dunn & Dunn, 1997). Pete's adaptive behavior composite score on the Vineland Adaptive Behavior Scales (Sparrow, Balla, & Cicchetti, 1984) was an age equivalent of 5 years 5 months. Sean was 7 years old at the start of the study. Prior to the start of the study, he had received 4 years of educational services from PCDI. Sean's adaptive behavior composite score on the Vineland Adaptive Behavior Scales was an age equivalent of 1 year 8 months and his Peabody Picture Vocabulary Test score was an age equivalent of 2 years 11 months.

All of the children had extensive experience with behavior analytic teaching procedures including lengthy experience with language instruction using script-fading technologies. All three children had relatively low levels of stereotypic responses such as tensing, finger play, and non-contextual laughter. All three boys typically received

instruction in sessions with a two-to-one student-to-instructor ratio throughout the school day. Additionally, they were able to respond to typical classroom instructions without assistance. All of the children also used token-based motivational systems extensively. Written informed consent was provided by each student's parents prior to the start of the study.

Setting

Materials and Equipment. All teaching and generalization sessions were conducted in a classroom at PCDI. Prior to entering the classroom an Audio-Technica® Pro 88W/R wireless microphone transmitter and an Audio-Technica® MT830MW omni-directional microphone were clipped to the student's clothing. The wireless receiver was connected to a Sony® model CCD-TR930 videocassette camera/recorder. All teaching and generalization sessions were videotaped and scored after each session. In addition, a single-bank mechanical counter, used to record points earned, was clipped to the participant's clothing before entering each session. The mechanical counter was a metal cylinder that is 4.5 cm in diameter and 3 cm tall. It had a button that when pressed incremented a mechanical counter inside the device. Each press of the button caused the numeral displayed on the mechanical counter to be increased by one. A small knob on the side of the mechanical counter was turned to reset the number to zero. The classroom used for teaching and generalization sessions was 3 m by 5 m with a carpeted floor.

Pre-teaching classroom. During the stimulus and reading pre-teaching phases, the classroom contained a table and two typical desk chairs. The table was placed in the center of the room with one chair on either side of the table facing one another. In

addition, a large, opaque, plastic box was placed on the instructor's side of the desk. The box contained the stimulus materials that were presented during stimulus pre-teaching. During pre-teaching a token-based motivational system was placed on the desk between the student and the instructor. The stimuli used in each of the mock stores listed below will be described in the stimulus materials section.

Mock stores. The classroom was reconfigured to create three mock stores. The table and chairs were removed and replaced with shelves. In the videotape rental store setting videotapes were arranged on the shelves so that the participant could easily see and handle the videotapes. The mock sporting goods store was created by displaying a variety of sporting goods such as balls, helmets, and golf clubs. In the mock convenience store, snack foods were arranged to resemble a typical convenience store snack food display. In each of the three mock stores the stimulus materials were arranged so that the participants could obtain and manipulate them without assistance.

Community stores. Three retail stores were used as the community settings for the pre- and post-tests. The community setting for the videotape-rental-store condition was the family section of a local-video-rental store. The sporting-goods section of a local discount store was used as the community setting for the sporting-goods condition. Community pre- and post-test sessions for the convenience-store setting were conducted in the snack food section of a local delicatessen. Before conducting each session, each community store was visited to verify that all stimulus items were available on the shelves. If students attempted to leave the specific section of a community store during

data collection activities manual guidance was used to direct them back to the appropriate section of the store.

Instructor and Conversation Partner

The instructor was a doctoral student in psychology with training in applied behavior analysis. He conducted all pre-teaching, teaching, and generalization sessions. A PCDI instructional staff member served as a conversation partner for Rand. Although Rand was familiar with the conversation partner, the partner was not currently assigned as one of Rand's instructors. The instructor served as both the instructor and conversation partner for Pete and Sean.

Dependent Measures

The dependent measures included frequencies of scripted and unscripted interactions for the teaching stimuli and unscripted interactions for the generalization stimuli. Data from all sessions were scored from video or audio recordings made during each session.

Interactions. Interactions were defined as verbal responses made by the participant that were directed to the conversation partner by using the partner's name, orienting to the partner, or using a gesture to gain the partner's attention. Interactions did not need to be grammatically correct, they did, however, have to be understood by the conversation partner. To be scored as an interaction, verbal responses had to contain a noun and a verb and be separated from the student's prior verbal response by a change in topic or a verbal response from the conversation partner. Verbal responses made to people other than the conversation partner, verbal responses that were verbally or

gesturally prompted, verbal responses that were repetitions of the immediately prior response of the student or the conversation partner, and verbal responses made in response to questions asked by the conversation partner were not scored as interactions (Krantz & McClannahan, 1998).

Scripted interactions. Those interactions that matched scripts that were presented in the current session were scored as scripted interactions. Interactions that differed only in conjunctions, articles, prepositions, and/or pronouns were also scored as scripted interactions. When partial scripts were presented, interactions that included the partial script along with additional words were scored as scripted if they met the interaction criteria listed above. Interactions that differed in any other respect from the script were not scored as scripted interactions (Stevenson, Krantz, & McClannahan, 2000).

Unscripted interactions. Interactions that did not match any of the scripts presented in the current session were scored as unscripted interactions. If there were no scripts present during a session all interactions in that session were scored as unscripted interactions. Consequently there could be no scripted interactions during the response-contingent modeling phase or after fading level 6 in the script-fading phase. If a student constructed an interaction that was similar to the content of a script, it was scored as an unscripted interaction if it differed from the script by more than conjunctions, articles, prepositions, or pronouns. For example, if a student said "I like green M and M's," which is similar to the script "I like the red M and M's," it was scored as an unscripted interaction because the adjective was changed. If, on the other hand, the student had said "You like the red M and M's." the interaction would have been scored as a scripted

interaction because the only difference was that the student changed the pronoun "I" to "you."

Generalization interactions. Any interaction that met the definition of an interaction and referred to one of the generalization stimuli was scored as a generalization interaction.

Stimulus Materials

Six sets of stimuli were used in the experiment. The nine videotape-teaching stimuli and associated scripts are listed in Table 1. Table 2 lists the specific movies that were used as generalization stimuli in the videotape condition. Table 3 lists the convenience store teaching stimuli and scripts. The generalization stimulus set for the mock convenience store is shown in Table 4. The stimuli, in addition to the scripts, that were used for the sporting goods teaching stimulus set are listed in Table 5. The stimuli that were used for the sporting goods generalization stimulus set are listed in Table 6.

Procedure

The current study was conducted during the spring and summer, 2002, school sessions at the Princeton Child Development Institute.

Mechanical counter pre-teaching. Given that portions of this study were to take place in the community, an unobtrusive reinforcement system was designed. The use of a mechanical counter was designed to create a reinforcement system so that the student would notice every point earned while minimizing the likelihood that others in the community setting would notice the delivery of points. To insure the participants' successful use of the reinforcement system pre-teaching was conducted. This pre-

teaching was completed prior to stimulus and reading pre-teaching. Mechanical counter pre-teaching was conducted during a discrete-trial picture-labeling task. After each correct answer, the instructor pressed the button on the mechanical counter in his possession. If the student pressed the button on his mechanical counter, the instructor delivered a token on his token board. If he did not press the button on his mechanical counter, the instructor manually guided him to press the button on his mechanical counter. When the student earned ten tokens on his token board, he exchanged them for a preferred snack.

Stimulus pre-teaching. Stimulus pre-teaching sessions were conducted prior to the community pre-tests. Stimulus pre-teaching was conducted to insure that the students could identify all of the stimuli that were used in the study. During stimulus pre-teaching sessions, the student and instructor were seated in the classroom on opposite sides of the table. The 54 stimulus items were presented to the student one at a time and the instructor asked: "What is this?" If the student correctly labeled the object, the instructor delivered a token and descriptive praise. If the student did not correctly label the object the instructor provided the correct answer and no token was delivered. Stimulus pre-teaching continued until all of the objects were correctly labeled in a single session. If the student gave a non-specific answer such as "ball" when presented with one of the balls, the instructor asked a follow-up question. The follow-up questions used the following form: "What kind of _____ is it." For example, if the student said "ball" when presented with a football the instructor asked "What kind of ball is it?" Correct answers to either the primary or the follow-up question were scored as correct for that item.

Reading pre-teaching. Prior to the community pre-tests, the students were taught to read each of the 93 words that were used in the scripts. During reading pre-teaching sessions, flash cards with a single script word on each card were presented to the student and the student was asked to read the word. If the student correctly read a word, the instructor delivered a token on his token board and descriptive praise. Typical descriptive praise statements included "Good, you read 'cookies.'" and "Great, that was 'helmet.'" If the learner did not correctly read a word the instructor stated the correct answer and no token was delivered. Reading pre-teaching continued until all of the words were read without prompts in a single session.

Community store pre-tests. Prior to the first response-contingent modeling session, the students' conversation performances were measured in all three community stores. During all community pre-test sessions audio recordings were made and scored after the session by the instructor and an additional scorer. Each community pre-test session began when the conversation partner, instructor, and student were in the specified section of the community store. During the pre-test session the student was free to wander around the specified section of the store. The conversation partner and the instructor remained within 1.5 m of the student at all times. Community pre-test sessions lasted for five minutes in each of the three stores. During community pre-test sessions, no programmed consequences were delivered.

Response-contingent modeling. After the conclusion of the community store pre-test sessions, data collection began in the response-contingent modeling phase in all three settings for each participant. Response-contingent modeling sessions were conducted in

the appropriate mock store. Upon entering the "store," the session was started. Because Pete and Sean used a combined instructor/conversation partner, the partner remained facing and within 1.5 m of the student. Rand's conversation partner remained facing and with 1.5 m and his instructor remained behind him. The students were free to browse through the items in the mock store and were allowed to handle the items if they chose. If a student emitted an interaction, the conversation partner responded with an appropriate conversational response. Response-contingent modeling sessions for Pete and Sean were three minutes long. Because of his more advanced language, Rand's sessions were five minutes long. No programmed consequences were delivered for interactions during response-contingent modeling sessions. The conversation partner, however, did model an appropriate conversational statement after each interaction emitted by the student.

Script fading. After the response-contingent modeling data stabilized, the script-fading intervention was started in the first setting of the multiple-baseline design for each youth. During script-fading sessions the instructor/conversation partner was present in the mock store for Sean and Pete. During Rand's sessions, the instructor and conversation partner were present. As in the community pre-test sessions and the response-contingent modeling sessions the instructor/conversation partner remained within 1.5 m of the student at all times.

During script fading, printed scripts were attached to each stimulus. The scripts were set in an 18-point Times New Roman font on clear self-adhesive labels. The labels were 1-cm tall and the length of each label was trimmed so that the script words just fit on the label with no extra label remaining. These labels were attached to each stimulus in

an unprinted area of the stimulus. Correct placement of the scripts was verified prior to each session. In addition, the location of the label was moved after each change in fading level.

During the initial script-fading sessions, if a student did not say any of the scripts to the conversation partner within 30-s of entering the mock store or within 30-s of the last interaction they were manually guided to point to a script. Independent use of the scripts was reinforced by prompting the students to deliver points on their mechanical counters for scripts that were recited without prompts. The instructor operated a separate mechanical counter to prompt the student to self-deliver points on the mechanical counter attached to the student's clothing. Both unscripted interactions and scripted interactions were reinforced with points. These points were exchanged for a preferred snack after each session.

As soon as a student emitted at least 10 interactions without any script-reading prompts in a single session, no additional prompts to read scripts or initiate interactions were delivered during the rest of the study. In addition, when the student met this criterion, the script fading procedure began. The fading levels that were used in the experiment are shown in Table 7.

Three fading levels were used to reduce the scripts from full scripts to only the first word of the script. To enhance the probability of transfer of stimulus control from the scripts to the teaching items the first word was faded from the scripts using a strategy that gradually removed the script from an increasing proportion of the teaching items. This was accomplished during fading levels 4 through 6. In addition, as the number of

items with scripts was reduced the scripts appeared on different items during each successive session. The scripts were removed from three of the nine teaching stimuli at fading level 4. During sessions at fading level 5 the scripts were completely removed from 6 teaching items and remained on three teaching items. For fading level 6 the first word of a script remained on only a single teaching item. Finally, during fading level 7 sessions there were no scripts present. When a student correctly used each script present during a session at least once he was immediately moved to the next fading level. Fading continued until the student completed fading level 7. After stable responding was observed in each of the three mock-store settings, the community post-test sessions were conducted.

Generalization measures. Throughout the response-contingent modeling and script-fading phases of the experiment three generalization stimuli, in addition to the nine teaching stimuli, were displayed during each session. The generalization stimuli were block randomized such that over three sessions each of the generalization stimuli would have been present in each mock store for a single session. By combining the data from each group of three successive sessions a measure of the complete set of generalization stimuli was obtained. No points were delivered for interactions referring to generalization stimuli. The conversation partner, however, did provide an appropriate conversational statement in response to generalization interactions. At no time during the experiment were any scripts placed on the generalization stimuli.

Community store post-tests. After the completion of script fading in all three mock-store settings, interactions were examined in the community stores. The

community store post-test sessions were identical to the community store pre-test sessions.

Experimental Design

A multiple-baseline-across-settings experimental design was used to evaluate the effects of the intervention package (Baer, Wolf, & Risley, 1968). The intervention strategy, used in the experiment, included scripts, a script-fading procedure, and reinforcement for engaging in conversation (Krantz & McClannahan, 1993; Krantz & McClannahan, 1998; Stevenson, Krantz, & McClannahan, 2000). Students were prompted to deliver points on their mechanical counters for scripted and unscripted interactions that they emitted. These points were exchanged, after each session, for a preferred snack. The intervention package was introduced serially for each setting. For Rand the intervention package was introduced in the convenience store, followed by the videotape rental store, then by the sporting goods store. For Pete, the intervention package was applied to the convenience store, then the sporting goods store, and finally the videotape rental store. Sean received intervention in the videotape rental store first, followed by the convenience store, and finally by the sporting goods store.

Generalization of conversational skills to the generalization stimulus items was measured throughout the study. In addition, the students' performances were evaluated in community settings prior to the intervention and after the completion of intervention.

Data Analysis

The data from each session were summarized by reviewing the session video or audio recording and scoring each utterance as a scripted interaction, an unscripted

interaction, or a generalization interaction. The data were then summarized as the number of scripted interactions and the number of unscripted interactions per minute. In addition, after every third session the number of generalization interactions in that session and the previous two sessions were combined to yield the number of generalization interactions per minute. A maximum of five viewings was allowed for each segment of tape.

Interobserver agreement. Two observers scored a sample of the videotaped sessions. Each observer independently scored each interaction as a scripted interaction, an unscripted interaction, or a generalization interaction. Independence of the scorers was obtained by having them score the tapes at different times. Prior to scoring the videotapes, pairs of scorers were trained using videotapes made during a pilot study. They were trained until they achieved at least 80% interobserver agreement on each measure in a single session. Training was conducted by having the observers review the portions videotapes in which they disagreed about their scoring and discuss their interpretation of the discrepant utterances. After each training session another pilot session was independently scored by the two observers and then discussed. They repeated the training/scoring sequence until they met the 80% interobserver agreement criterion.

For the purposes of collecting interobserver agreement data each videotape contained a time track that indicated the running time within the session. For each utterance each observer recorded the time that the interaction began to the nearest second and the type of interaction. Interobserver agreement was assessed on a point-by-point basis. To be scored as an agreement both observers had to score an interaction as the same type of interaction and code the time within one second of the other observer.

Interactions that were coded with different interaction types or that were not coded as occurring within one second of the other observer's time were scored as disagreements. The interobserver agreement percentage was calculated by dividing the number of agreements by the number of agreements plus the number of disagreements and multiplying by 100.

During the final session of mechanical counter pre-teaching. interobserver agreement data indicated 100% agreement for Rand's performance, 100% agreement for Pete's performance, and 96% agreement for Sean's performance. Interobserver agreement was 100% for Rand's and Pete's final reading pre-teaching sessions. Interobserver agreement data were 98% for Sean's last session of reading pre-teaching. During Rand's, Pete's, and Sean's last session of stimulus pre-teaching interobserver agreement was 100%.

Table 8 shows Rand's interobserver agreement data for the experiment. As shown in the table, during response-contingent modeling, interobserver agreement on Rand's unscripted interactions was 100%. Because no scripts were present during the response-contingent modeling phase interobserver agreement data were not computed for scripted interactions. During the script-fading phase agreement had a range of 93 to 98%. Data were obtained for 44% of Rand's sessions (21 of 48 sessions).

Table 9 displays the interobserver agreement for Pete's performance. Data were collected on 33% of Pete's sessions (20 of 60 sessions). During the response-contingent modeling sessions, in which interobserver data were collected, Pete did not emit any

interactions. Thus, no opportunities to obtain interobserver agreement were available. During the script-fading phase interobserver agreement had a range of 90 to 97%.

Interobserver agreement data were collected on 23 of Sean's 69 sessions (33%). Table 10 shows the interobserver agreement data for Sean's performance. During response-contingent modeling interobserver agreement was 100%. As shown in the table, during the script-fading phase interobserver agreement percentages were between 82 and 93%, inclusive.

Interobserver agreement data for the community pre- and post-test sessions are shown in Table 11. During the community pre-test session none of the three participants emitted any interactions and neither scorer recorded any interactions so interobserver agreement could not be computed. Interobserver agreement during the community post-test sessions had a range of 89 to 100%.

Results

Pre-teaching. As described in the procedure section pre-teaching was conducted to insure that the youths could operate the mechanical counter, could identify all of the stimulus items, and could read all of the script words. Tables 12, 13, and 14 show the mechanical counter, stimulus, and reading pre-teaching data for Rand, Pete, and Sean, respectively. None of the boys pressed the button on his mechanical counter during any of the pre-test trials. Rand completed mechanical counter pre-training in five sessions. Pete successfully completed mechanical counter pre-teaching in two sessions. Sean successfully learned to press the button on his mechanical counter in six pre-teaching sessions.

Rand only required two pre-teaching sessions to learn to read each of the 104 words correctly. Pete completed reading pre-teaching in 12 sessions. Sean reached the criterion of 100% accuracy in reading the script words in 18 sessions. During the initial stimulus pre-training session Rand, Pete, and Sean could correctly label 80, 39, and 19% of the stimuli, respectively. Rand required 10 sessions to complete stimulus pre-teaching. Pete finished the stimulus pre-teaching in 14 sessions. Sean required 24 sessions to complete stimulus pre-teaching.

Interaction Data. Figure 1 shows Rand's data from the experiment. Sessions are shown on the abscissa. The number of interactions per minute is shown on the ordinate. The solid line between sessions 6 and 7 in the top panel indicates the condition change from response-contingent modeling to script fading. Fading levels are indicated by numbered arrows along the top of each panel. Unscripted interactions are indicated by the filled circles. The open squares represent generalization interactions and the open circles indicate scripted interactions. The three panels of the figure show data from the convenience store on top, the video store in the middle, and the sports store in the bottom panel.

As seen in the top panel of Figure 1, during the response-contingent modeling phase, Rand did not emit any unscripted interactions (filled circles) in the convenience-store setting. With the introduction of the script-fading intervention, during session 7, Rand's scripted interactions (open circles) increased to 13 interactions per minute over 2 sessions. Script fading, in the convenience-store setting, began during session 8. Rand's rate of scripted interactions systematically dropped as the fading level increased. Between

sessions 9 and 13 the number of interactions per minute dropped to near zero levels and remained low until the final script was removed at session 16.

As shown in the top panel of Figure 1, with the introduction of the script-fading intervention, unscripted interactions (filled circles) increased to 12 interactions per minute over the first 9 script-fading sessions. During the remaining 27 sessions the rate of unscripted interactions had a range of 11 to 15 interactions per minute in the convenience-store setting.

During the response-contingent modeling phase no generalization interactions (open squares) were emitted. With the introduction of the script-fading intervention Rand's rate of generalization interactions increased to 17 interactions per minute over the first 15 sessions of script fading. His rate of generalization interactions had a range of 13 to 18 interactions per minute during the remaining sessions in the convenience-store condition.

The middle panel of Figure 1 shows Rand's interaction data in the video-store setting. Rand's performance in the video-store setting closely paralleled his performance in the convenience-store setting. During the response-contingent modeling phase he did not make any unscripted interactions. During the first session of the script-fading phase, scripted interactions increased to 10 interactions per minute. Scripted interactions remained between 10 and 12 interactions per minute through fading level 3. Between fading level 3 and fading level 6 the rate of scripted interactions dropped to 2 interactions per minute over 3 sessions.

With the introduction of the script-fading procedure in the video-store setting Rand's rate of unscripted interactions increased from zero during baseline to 10 interactions per minute across 10 sessions. The rate of unscripted interactions remained between 9 and 13 interactions per minute for the rest of the study. During the response-contingent modeling phase Rand did not emit any interactions in the video-store setting. With the introduction of the script-fading procedure generalization interactions systematically increased to 9 per minute during sessions 19 to 27. Generalization interactions had a range of 8 to 13 interactions per minute throughout the rest of the experiment.

Rand's performance in the sports-store setting was similar to the convenience and video stores. There was, however, a session in the response-contingent modeling phase that reached almost 6 unscripted interactions per minute. All other sessions during the response-contingent modeling phase showed zero rates of unscripted interactions. In the script-fading phase Rand's scripted interaction performance was similar to his performance in the convenience and video stores. He made 12 scripted interactions per minute during the first intervention session. His rate of scripted interactions systematically dropped to 1 interaction per minute across the first 6 fading levels in sessions 31 through 36.

In the sports store, Rand's rate of unscripted interactions remained low during the first four sessions in the script-fading phase. Between sessions 34 and 35 the rate of unscripted interactions increased from near zero levels to 7 interactions per minute. Unscripted interactions had a range of 5 to 8 interactions per minute until the end of the

study. Between sessions 30 and 36 Rand's rate of generalization interactions increased from less than 1 to more than 5 interactions per minute. The final two generalization data points had a range of 6 to 7 interactions per minute.

Figure 2 shows Pete's performance across the convenience-, sports-, and video-store settings in the experiment. With the introduction of the script-fading procedure Pete's rate of unscripted interactions systematically increased. Pete's performance essentially parallels Rand's performance with a few exceptions. Pete never emitted any unscripted or generalization interactions during the response-contingent modeling phase in any of the three store settings. In both the convenience and sports stores Pete showed slower acquisition of scripted responding than Rand. Pete received the script-fading intervention in the convenience-store setting first. Pete's use of scripted interactions increased from less than 1 per minute to 6 per minute during sessions 7 through 12. Pete's use of scripted interactions in the video-store setting was similar to Rand's typical pattern. In the video store Pete's scripted interactions increased to 3 interactions per minute during the first script-fading session. Then they systematically decreased as each successive fading level was reached. Although the acquisition of generalization interactions typically paralleled the acquisition of unscripted interactions, Pete showed an increase in his generalization interactions in the video-store setting that occurred prior to the increases in unscripted interactions.

Figure 3 displays Sean's data across the video-, convenience-, and sports-store settings in the experiment. Sean's performances are generally similar to Rand and Pete's performances. With the introduction of the script-fading procedure Sean's rate of

unscripted interactions systematically increased. Sean never emitted any unscripted or generalization interactions during the response-contingent modeling phase in either the video store or the convenience store. He did, however, emit low rates of generalization interactions in three of the response-contingent modeling sessions in the sports-store condition. Sean's data are more variable than Pete or Rand's. In particular, Sean's performance in the sports-store setting was quite variable throughout the script-fading sequence. With the completion of the script-fading sequence, however, both his unscripted interactions and his generalization interactions remained between 3 and 4 interactions per minute.

Community pre- and post-test data. Figure 4 displays the data for the community pre- and post-test sessions. None of the three youths emitted any interactions in any of the stores during the community pre-test sessions. After the intervention all three boys showed increases in the rate of interactions. These increases had a range of 2 to 13 interactions per minute. Each boy received pre- and post-test sessions in three community stores. Each of the youths showed increases in the rate of interactions in all three of the community stores during the post-tests.

Reinforcement rate. The rate of reinforcement was scored during four sessions for each youth. The obtained reinforcement rates are shown in Table 15. As planned, no reinforcement was delivered during the response-contingent modeling conditions. During the script-fading conditions reinforcement was delivered on a VR2.5 for Pete and Rand. Sean received reinforcement on a VR2.0.

Response-Contingent Modeling. The conversation partner's implementation of language modeling was measured in four sessions for each youth. As described in the procedure section, the response-contingent modeling required that the conversation partner model an appropriate conversational statement after each interaction made by the participant. The percentages of unscripted, scripted, and generalization interactions emitted by the participant that were followed by a response-contingent model from the conversation partner are shown in Table 16. The percentage of student interactions that were correctly followed by a response-contingent model from the conversation partner had a range of 90 to 100%.

Discussion

Conclusions. With the introduction of the script-fading package all three boys showed systematic increases in the rate of unscripted interactions. Furthermore, all three boys also demonstrated systematic increases in the rate of generalization interactions after the introduction of the script-fading package. Because the changes for each youth occurred with the introduction of the script-fading package in each of the three mock-store settings it can be concluded that the script-fading intervention caused the increases in conversational interactions.

Prior to intervention, during shopping trips in the community all three boys failed to verbally interact with the conversation partner. After the intervention, during the community post-test sessions, all three boys demonstrated increased conversational interactions during shopping trips to the same three stores. The youths demonstrated increased rates of interactions during 9 of 9 post-test opportunities. The community post-

tests represent an important measure of the generalization of the youths' newly acquired conversation skills. After the script-fading intervention in mock stores, all three boys engaged in conversation during shopping trips to stores in their communities. The script-fading procedure used in the experiment was successful in promoting a shift in stimulus control from the scripts to stimuli in the natural environment. Perhaps in the community post-tests the presence of the conversation partner and an item of interest served as a compound stimulus that set the occasion for the youths' conversational interactions.

A number of procedures identified by Stokes and Baer (1977) may have contributed to the successful generalization of conversational interactions from the teaching stimuli to the generalization stimuli. The conversation partner's responses may have served as a natural contingency of reinforcement sufficient to maintain conversational interactions about the generalization stimuli. Teaching conversational responses to nine stimuli in each store setting may have served to teach enough exemplars to promote generalization to the untaught stimuli. Placing the teaching stimuli on the mock store shelves intermixed with the generalization stimuli might have helped the teaching stimuli to serve as common stimuli and therefore promoted generalization. The use of a variable-ratio schedule of reinforcement for conversational responses about the teaching items may have helped to create an indiscriminable contingency of reinforcement.

The current experiment was designed to examine the extent to which script-fading procedures can help youth with autism learn to engage in social conversation. All three participants, prior to the study, were able to engage in conversation when they were

prompted to do so by an activity schedule or their instructors. In a typical community activity, shopping in this case, they did not engage in conversation. The data from the current study indicate that script fading can be a successful technique for teaching individuals with autism to engage in conversation.

Teaching the youths to use scripts that were placed on familiar items was successful in promoting their initiation of conversation. Subsequent fading of the scripts allowed the combination of a stimulus item and the conversation partner to gain stimulus control of their conversational skills. The current study represents an important shift from instructor-mediated to natural-environment control of language for individuals with autism.

It was assumed that all three youths that participated in this study had the requisite language skills to engage in conversation. The purpose of this study was not to teach new language but to evoke existing language under new stimulus conditions. Although it was assumed that it was important to write scripts that were within the boys' current language capacities this was not assessed. In future studies it would be important to examine the extent to which these procedures could be used to teach new language along with the stimulus control needed for engaging conversation in a natural environment.

Future studies might also consider the content of the language emitted during script-fading procedures. Specifically, does a script-fading procedure simply evoke language that was present in the repertoire? Script fading might be used to teach new language content that was not in the repertoire. It might also result in the construction of novel language. Anecdotally, it was observed that although the boys were taught 27

different sentences about the stimulus items they tended to use a subset of those sentence structures. They did, however, alter the sentences to use a variety of untaught nouns and adjectives and thus created novel sentences. A more formal content analysis of script-fading procedures would certainly be informative, however, such an analysis would be extraordinarily time consuming to conduct.

This study focused on the development of natural-environment stimulus control needed for the occurrence of conversational language. Although the study was successful in teaching the needed stimulus control, the conversational responses were maintained by intermittent reinforcement in the form of points earned for conversational statements. Altering the reinforcement contingencies that support the behavior could make a further shift toward natural-environment control of conversation. Perhaps, an examination of how to make the responses of the conversation partner function as a reinforcer would be fruitful. Alternately, access to the stimuli serving as conversation topics could function as naturalistic reinforcers.

Table 1

Teaching Stimuli for the Mock Videotape Rental Store Used in the Experiment

Videotape	Script
Antz	"This movie is about bugs."
Black Beauty	"That horse is big."
Cats and Dogs	"Check out the white Cat."
Gordy	"What's on the pig's neck?"
Hercules	"She is wearing purple."
Rugrats in Paris	"Cartoons are funny."
The Lion King II Simba's Pride	"Lions are king of the jungle."
The Little Mermaid	"Stories about fish are great."
The Muppet Movie	"Kermit is wearing a hat."

Table 2

Generalization Stimuli for the Mock Videotape Rental Store Used in the Experiment

Videotape
The Aristocats
Babe
Beauty and the Beast
The Black Stallion
A Bug's Life
Free Willy
The Great Muppet Caper
The Lion King
The Rugrats Movie

Table 3

Teaching Stimuli for the Mock Convenience Store Used in the Experiment

Snack Food	Script
Almond Joy® Candy Bar	"Coconut is chewy."
Kit Kat® Candy Bar	"Chocolate tastes yummy."
Lay's® Potato Chips	"Potato chips are salty."
Mini Oreo® Cookies	"Little cookies are neat."
Reese's® Peanut Butter Cups	"Peanut butter is good."
Ritz Bits® Cheese Sandwich Crackers	"You eat the middle first."
Skittles®	"The red ones are best."
Snickers® Candy Bar	"Candy bars are sticky."
Wrigley's® Doublemint Chewing Gum	"Chewing gum is fun."

Table 4

Generalization Stimuli for the Mock Convenience Store Used in the Experiment

Snack Food
Butterfinger® Candy Bar
M&Ms® Chocolate Candies
Milky Way® Candy Bar
Mini Chips Ahoy® Cookies
Mounds® Candy Bar
Nutter Butter® Cookies
Reese Sticks® Candy Bar
Ruffles® Potato Chips
Wrigley's® Spearmint Chewing Gum

Table 5

Teaching Stimuli for the Mock Sporting Goods Store Used in the Experiment

Sports Equipment	Script
Baseball Batting Helmet	"A helmet goes on my head."
Baseball Glove	"I love to play catch."
Football	"Passing the ball is easy."
Frisbee® Flying Disk	"It's hard to throw it."
Golf Club	"I'll take a shot."
In-line roller skates	"Skating is my favorite."
Tennis Racquet	"Hitting the ball is cool."
Water Bottle	"Exercise makes you thirsty."
Wrist Guards	"Wear these when you skate."

Table 6

Generalization Stimuli for the Mock Sporting Goods Store Used in the Experiment

Sports Equipment
Baseball Bat
Basketball
Bicycle Helmet
Dumbbell
Hockey Stick
Knee Pads
Skateboard
Soccer Ball
Velcro® Catching Paddle

Table 7

Fading Levels Used During Script Fading in the Experiment

Fading Level	Remaining Script Content
Level 0	Full script
Level 1	Last word removed
Level 2	Last two words removed
Level 3	All but the first word removed
Level 4	All but the first word removed on 6 stimuli and no script on 3 stimuli
Level 5	All but the first word removed on 3 stimuli and no script on 6 stimuli
Level 6	All but the first word removed on 1 stimuli and no script on 8 stimuli
Level 7	No scripts

Table 8

Mean Percentage of Interobserver Agreement (IOA) and Number of Observations (n) for Rand's Performance in the Experiment

	Response-Contingent			
Interaction Type	Modeling		Script-Fading	
	IOA	n	IOA	n
Scripted			93	254
Unscripted	100	29	98	1111
Generalization		0	98	425

Table 9

Mean Percentage of Interobserver Agreement (IOA) and Number of Observations (n) for Pete's Performance in the Experiment

Interaction Type	Response-Contingent Modeling		Script-Fading	
	IOA	n	IOA	n
Scripted			97	117
Unscripted		0	94	325
Generalization		0	90	106

Table 10

Mean Percentage of Interobserver Agreement (IOA) and Number of Observations (n) for Sean's Performance in the Experiment

Interaction Type	Response-Contingent Modeling		Script-Fading	
	IOA	n	IOA	n
Scripted			93	177
Unscripted	100	1	92	607
Generalization	100	4	82	184

Table 11

Mean Percentage of Interobserver Agreement (IOA) and Number of Observations (n) for the Community Pre- and Post-Test Sessions

		Pre-Test Session		Post-Test Session	
Participant	Store	IOA	n	IOA	n
Rand					
	Convenience		0	100	65
	Sports		0	100	38
	Video		0	98	53
Pete					
	Convenience		0	100	20
	Sports		0	89	9
	Video		0	100	6
Sean					
	Convenience		0	100	15
	Sports		0	100	12
	Video		0	100	13

Table 12

Rand's Mechanical Counter, Stimulus, and Reading Pre-Teaching Data, and Number of Trials (n)

	Pre-Test		Post-Test	
Condition	% Correct	n	% Correct	n
Counter Pre-Teaching	0	25	100	25
Stimulus Pre-Teaching	80	60	100	60
Reading Pre-Teaching	99	104	100	104

Table 13

Pete's Mechanical Counter, Stimulus, and Reading Pre-Teaching Data and Number of Trials (n)

	Pre-Test		Post-Test	
Condition	% Correct	n	% Correct	n
Counter Pre-Teaching	0	25	100	25
Stimulus Pre-Teaching	39	54	100	54
Reading Pre-Teaching	69	93	100	93

Table 14

Sean's Mechanical Counter, Stimulus, and Reading Pre-Teaching Data and Number of Trials (n)

Condition	Pre-Test		Post-Test	
	% Correct	n	% Correct	n
Counter Pre-Teaching	0	25	100	25
Stimulus Pre-Teaching	19	54	100	54
Reading Pre-Teaching	62	93	100	93

Table 15

Obtained Reinforcement Schedule During the Response-Contingent Modeling and Script-Fading Phases for Rand, Pete, and Sean

Participant	Response-Contingent Modeling		Script-Fading	
	Schedule	n	Schedule	n
Rand	Extinction	0	VR 2.5	190
Pete	Extinction	0	VR 2.5	42
Sean	Extinction	0	VR 2.0	48

Table 16

Percentage of Student Interactions Followed by a Response-Contingent Model from the Conversation Partner by Phase and Setting

		Response-Contingent			
		Modeling		Script-Fading	
Participant	Store	Interaction Percentage	n	Interaction Percentage	n
Rand					
	Convenience		0	100	253
	Sports		0	100	46
	Video		0	100	156
Pete					
	Convenience		0	97	64
	Sports		0	100	31
	Video		0	92	13
Sean					
	Convenience		0	100	36
	Sports		0	90	10
	Video		0	98	49

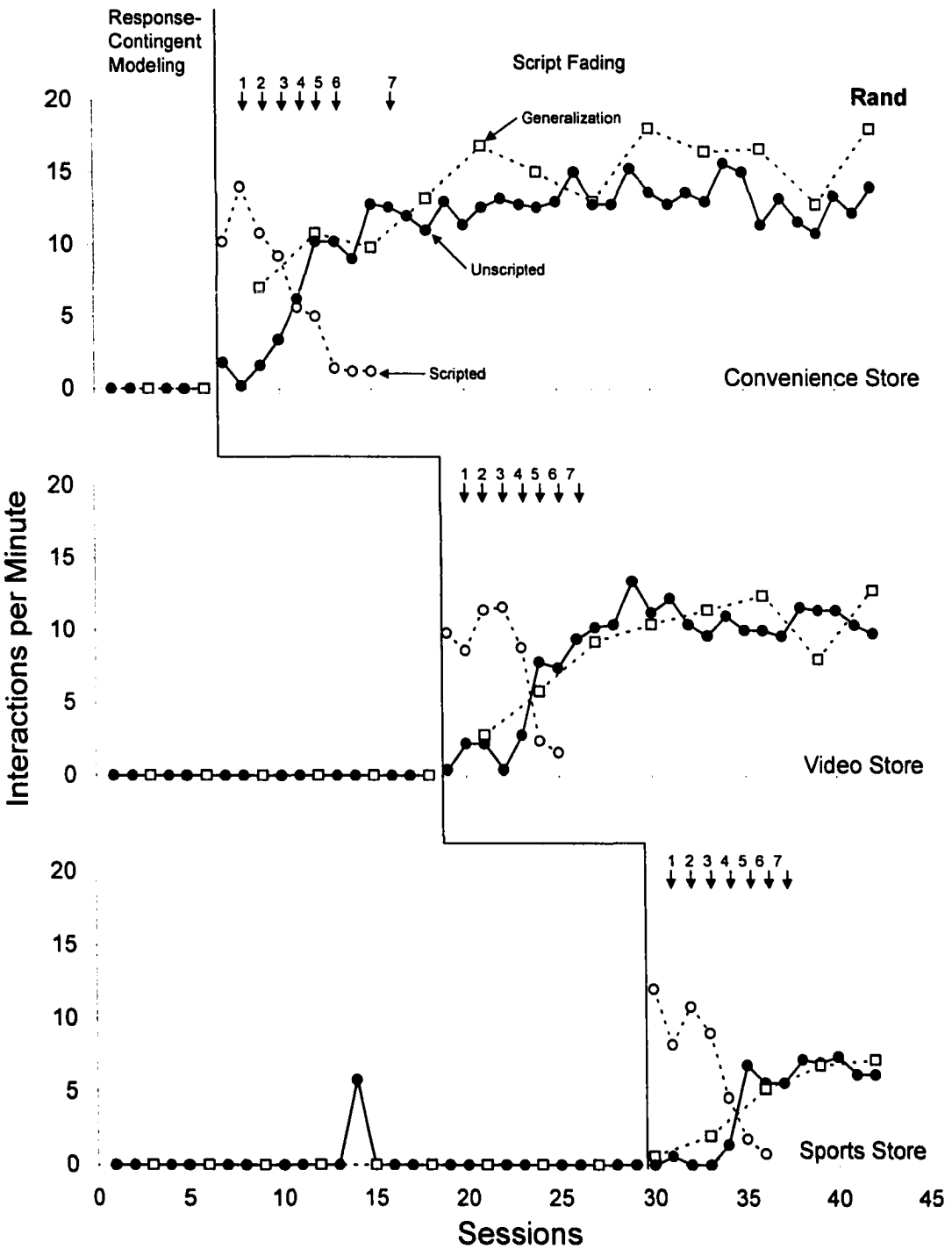

Figure 1. *Experiment Data for Rand:* The number of scripted, unscripted, and generalization interactions across the three mock stores are shown. Fading levels are indicated by numbered arrows.

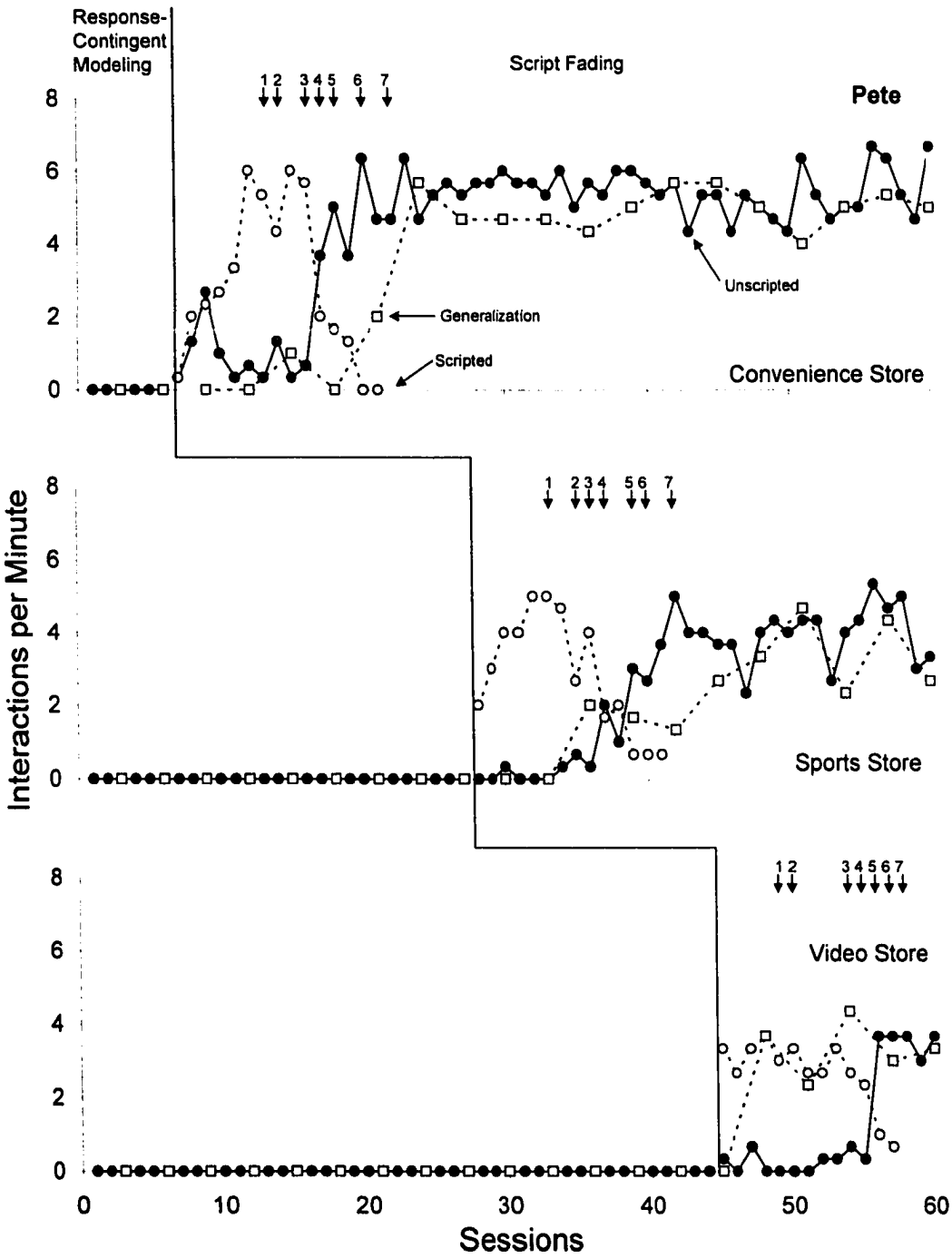

Figure 2. *Experiment Data for Pete:* The number of scripted, unscripted, and generalization interactions across the response-contingent modeling and script-fading phases are shown for the three mock stores. Fading levels are indicated by numbered arrows.

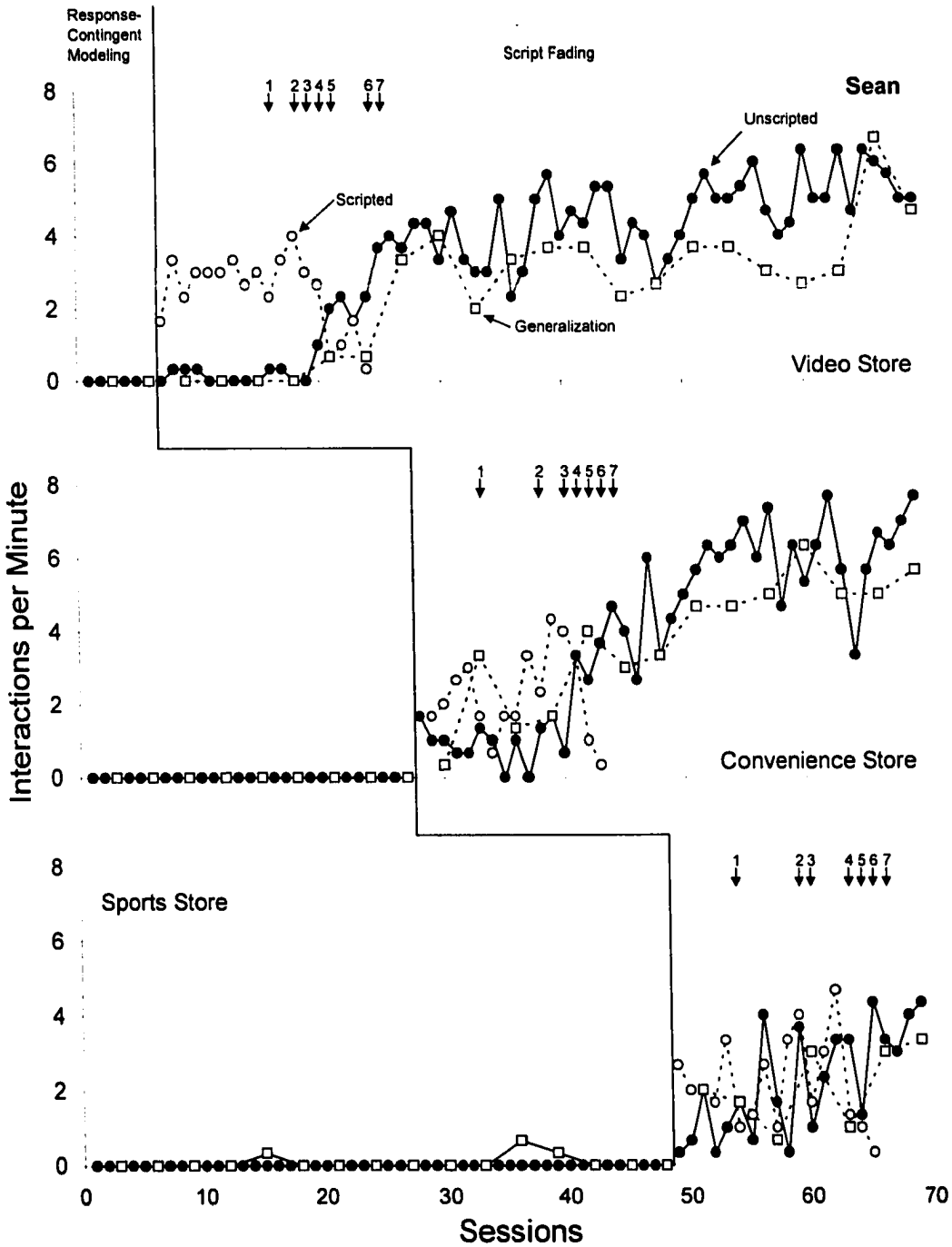

Figure 3. *Experiment Data for Sean:* The number of scripted, unscripted, and generalization interactions across the response-contingent modeling and script-fading phases are shown for the three mock stores. Fading levels are indicated by numbered arrows.

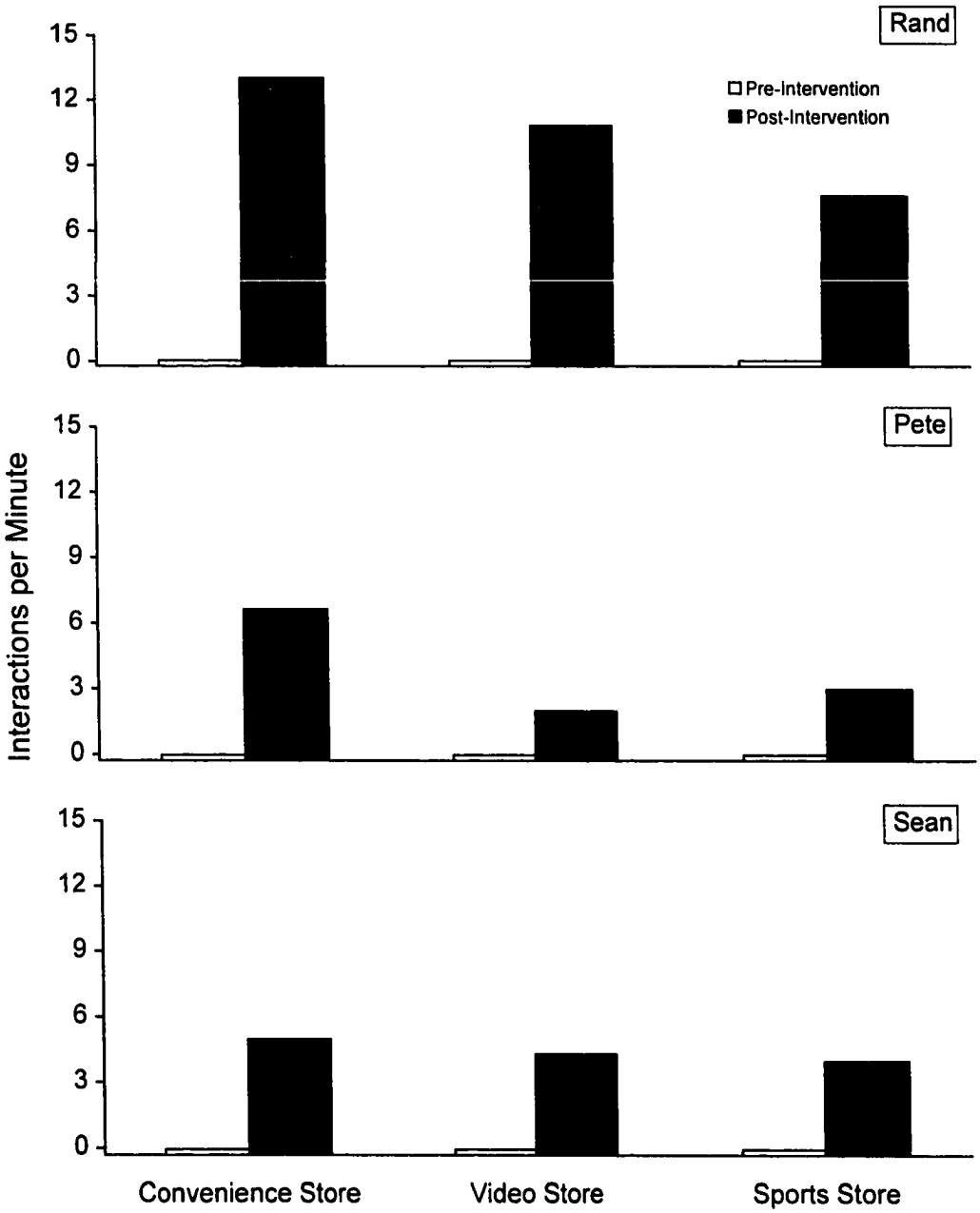

Figure 4. *Community Pre- and Post-Test Data:* The number of interactions during the pre- and post-test sessions in community stores for all three participants is shown.

Appendix

Pilot Study

Method

Participants

One child with autism participated in the pilot study. Rand was a student at the Princeton Child Development Institute (PCDI). He was independently diagnosed with autism by a qualified professional who was not affiliated with PCDI. He met the criteria for autism defined in the Diagnostic and Statistical Manual of Mental Disorders 4th ed, text revision (American Psychiatric Association, 2000). Rand was able to communicate using spoken language, but he had difficulties making social initiations. Rand was 13 years old at the start of the study. He had received 10 years of educational services from PCDI. Rand scored an age equivalent of 4 years 10 months on the Peabody Picture Vocabulary Test (Dunn & Dunn, 1997) and his Vineland Adaptive Behavior Scale (Sparrow, Balla, & Cicchetti, 1984) composite score age equivalent was 4 years 0 months.

Rand had extensive experience with behavior analytic teaching procedures including lengthy experience with language instruction using script-fading technologies. He exhibited low levels of stereotypic responses such as tensing and non-contextual laughter. Rand typically received instruction in sessions with a two-to-one student to instructor ratio throughout the school day. He was able to respond to typical classroom instructions without assistance. In addition, Rand had extensive experience with token-

based motivational systems. His parents provided written informed consent allowing his participation prior to the start of the study.

Setting

Materials and Equipment. All teaching and generalization sessions were conducted in a classroom at PCDI. Prior to entering the classroom an Audio-Technica® Pro 88W/R wireless microphone transmitter and an Audio-Technica® MT830MW omni-directional microphone were clipped to Rand's clothing. The wireless receiver was connected to a Sony® model CCD-TR930 videocassette camera/recorder. All teaching and generalization sessions were videotaped and scored after each session. In addition, a single-bank mechanical counter, used to record points earned, was clipped to the participant's clothing before entering each session. The mechanical counter was a metal cylinder that is 4.5 cm in diameter and 3 cm tall. It had a button that when pressed incremented a mechanical counter inside the device. Each press of the button caused the numeral displayed on the mechanical counter to be increased by one. A small knob on the side of the mechanical counter was turned to reset the number to zero. The classroom used for teaching and generalization sessions was 3 m by 5 m with a carpeted floor.

Pre-teaching classroom. During the stimulus and reading pre-teaching phases, the classroom contained a table and two typical desk chairs. The table was placed in the center of the room with one chair on either side of the table facing one another. In addition, a large, opaque, plastic box was placed on the instructor's side of the desk. The box contained the stimulus materials that were presented during stimulus pre-teaching. During pre-teaching a token-based motivational system was placed on the desk between

the student and the instructor. The stimuli used in each of the mock stores listed below will be described in the stimulus materials section.

Mock stores. The classroom was reconfigured to create three mock stores. The table and chairs were removed and replaced with shelves. In the videotape rental store setting videotapes were arranged on the shelves so that the participant could easily see and handle the videotapes. The mock sporting goods store was created by displaying a variety of sporting goods such as balls, helmets, and golf clubs. In the mock convenience store, snack foods were arranged to resemble a typical convenience store snack food display. In each of the three mock stores the stimulus materials were arranged so that Rand could obtain and manipulate them without assistance.

Instructor and Conversation Partner

The instructor was a doctoral student in psychology with training in applied behavior analysis. He conducted all pre-teaching, teaching, and generalization sessions. A PCDI instructional staff member served as a conversation partner for Rand. Although Rand was familiar with the conversation partner, the partner was not currently assigned as one of Rand's instructors.

Dependent Measures

The dependent measures included frequencies of scripted and unscripted interactions for teaching stimuli and unscripted interactions for generalization stimuli. Data from all sessions were scored from video recordings made during each session.

Interactions. Interactions were defined as verbal responses made by the participant that were directed to the conversation partner by using the partner's name,

orienting to the partner, or using a gesture to gain the partner's attention. Interactions did not need to be grammatically correct, they did, however, have to be understood by the conversation partner. To be scored as an interaction, verbal responses had to contain a noun and a verb and be separated from the student's prior verbal response by a change in topic or a verbal response from the conversation partner. Verbal responses made to people other than the conversation partner, verbal responses that were verbally or gesturally prompted, verbal responses that were repetitions of the immediately prior response of the student or the conversation partner, and verbal responses made in response to questions asked by the conversation partner were not scored as interactions (Krantz & McClannahan, 1998).

Scripted interactions. Those interactions that matched scripts that were presented in the current session were scored as scripted interactions. Interactions that differed only in conjunctions, articles, prepositions, and/or pronouns were also scored as scripted interactions. When partial scripts were presented, interactions that included the partial script along with additional words were scored as scripted if they met the interaction criteria listed above. Interactions that differed in any other respect from the script were not scored as scripted interactions (Stevenson, Krantz, & McClannahan, 2000).

Unscripted interactions. Interactions that did not match any of the scripts presented in the current session were scored as unscripted interactions. If there were no scripts present during a session all interactions in that session were scored as unscripted interactions. Consequently there could be no scripted interactions during the response-contingent modeling phase or after the final fading level in the script-fading phase. If the

student constructed an interaction that was similar to the content of a script, it was scored as an unscripted interaction if it differed from the script by more than conjunctions, articles, prepositions, or pronouns. For example, if the student said "I like green M and M's," which is similar to the script "I like the red M and M's," it was scored as an unscripted interaction because the adjective was changed. If, on the other hand, the student had said "You like the red M and M's." the interaction would have been scored as a scripted interaction because the only difference was that the student changed the pronoun "I" to "you."

Generalization interactions. Any interaction that met the definition of an interaction and referred to one of the generalization stimuli was scored as a generalization interaction.

Stimulus Materials

Six sets of stimuli were used in the pilot study. The videotape teaching set consisted of ten recent movies that were typically marketed in the family section of video rental stores. Table A1 lists the specific movies that were used as videotape teaching stimuli. Table A1 also lists the scripts that were taught during the script-fading sessions. A second set of ten recent movies was used as a generalization stimulus set in the video-store condition. Table A2 lists the specific movies that were used as generalization stimuli.

The convenience store teaching stimulus set consisted of ten widely available snack foods used as stimuli. Table A3 lists the stimuli and scripts that were used for the convenience store stimulus set. The generalization stimulus set for the mock convenience

store used ten additional snack foods as stimuli. Table A4 lists the stimuli that were used for the convenience store generalization stimulus set.

The sporting goods teaching set used ten commonly available pieces of sports equipment as stimuli. The stimuli, in addition to the scripts, that were used for the sporting goods teaching stimulus set are listed in Table A5. Ten additional pieces of sports equipment were used for the generalization stimulus set in the mock sporting goods store. The stimuli that were used for the sporting goods generalization stimulus set are listed in Table A6.

Procedure

Mechanical counter pre-teaching. Mechanical counter pre-teaching was conducted prior to stimulus and reading pre-teaching. Mechanical counter pre-teaching was conducted to insure that Rand could operate the mechanical counter that was used as his motivational system. Mechanical counter pre-teaching was conducted during a discrete-trial picture-labeling task. After each correct answer, the instructor pressed the button on the mechanical counter in his possession. If Rand pressed the button on his mechanical counter, the instructor delivered a token on his token board. If he did not press the button on his mechanical counter, the instructor manually guided him to press the button on his mechanical counter. When Rand earned ten tokens on his token board, he exchanged them for a preferred snack.

Stimulus pre-teaching. Stimulus pre-teaching sessions were conducted prior to any generalization measurements or teaching sessions. Stimulus pre-teaching was conducted to insure that Rand could identify all of the stimuli that were used in the study.

During stimulus pre-teaching sessions, the student and instructor were seated in the classroom on opposite sides of the table. The 60 stimulus items were presented to the student one at a time and the instructor asked: "What is this?" If the student correctly labeled the object, the instructor delivered a token and descriptive praise. If the student did not correctly label the object the instructor provided the correct answer and no token was delivered. Stimulus pre-teaching continued until all of the objects were correctly labeled in a single session. If the student gave a non-specific answer such as "ball" when presented with one of the balls, the instructor asked a follow-up question. The follow-up questions used the following form: "What kind of _____ is it." For example, if the student said "ball" when presented with a football the instructor asked "What kind of ball is it?" Correct answers to either the primary or the follow-up question were scored as correct for that item.

Reading pre-teaching. Prior to generalization measurements, the student was taught to read all of the 104 words that were used in the scripts. During reading pre-teaching sessions, flash cards with script words were presented to the student and the student was asked to read each word. If the student correctly read a word, the instructor delivered a token on his token board and descriptive praise. Typical descriptive praise statements included "Good, you read 'cookies.'" and "Great, that was 'helmet.'" If the learner did not correctly read a word the instructor stated the correct answer and no token was delivered. Reading pre-teaching continued until all of the words were read without prompts in a single session.

Response-contingent modeling. After the conclusion of pre-teaching, data collection in the response-contingent modeling phase began for all three stimulus sets. The response-contingent modeling phase served as a baseline phase. Response-contingent modeling sessions were conducted in the appropriate mock store. Upon the student's entry to the mock store, the session began. The instructor remained unobtrusively behind the student. The conversation partner remained within 1.5 m of the student and faced the student. The student was free to browse through the items in the room and was allowed to handle the items. If the student emitted an interaction, the conversation partner responded with a response-contingent model. Response-contingent models consisted of conversational responses, made by the conversation partner, that were contextual and at the participants' level of expressive language. A statement was considered contextual if it referred to a stimulus that was displayed in the current setting. Statements that consisted of three to five words were considered at the participants' level of expressive language. Sessions were five minutes long. No points were delivered for interactions during the response-contingent modeling sessions, however, if the student emitted an interaction the conversation partner responded with an appropriate statement.

Script Fading. After the response-contingent modeling data stabilized, the script fading intervention was started in the convenience-store condition. During script-fading sessions the instructor and conversation partner were present in the mock store. The instructor remained behind the student as much as possible. The conversation partner, on the other hand, stayed within 1.5 m of the student and faced the student at all times. During script fading, written scripts were attached to each stimulus. The written scripts

were presented in an 18-point Times New Roman font on 7.5-cm by 3.8-cm white index cards that were attached to the stimuli. Correct placement of scripts was verified prior to each session. If the student did not say any of the scripts to the conversation partner within 30-s of entering the room or within 30-s of the last interaction, the instructor manually guided the student to point to a script. Independence in using the scripts was rewarded by prompting the student to deliver a point on the mechanical counter for each script that was recited without prompts. The instructor clicked his mechanical counter to prompt the student to self-deliver points on his mechanical counter. Both unscripted interactions and scripted interactions were reinforced with points recorded on the mechanical counter.

As soon as Rand emitted at least 10 interactions without any script-reading prompts in a single session, no additional prompts to read scripts or initiate interactions were delivered during the rest of the study. In addition, when Rand met this criterion the script fading procedure was started. The scripts were systematically faded from the last word to the first word. After the scripts were fully faded, the script card was removed. The fading levels that were used are shown in Table A7. When Rand correctly recited at least five scripted statements in a single session at one fading level, he was immediately moved to the next fading level. Fading continued until level 5 was reached.

Generalization sessions. Throughout the response-contingent modeling and script-fading phases of the pilot study generalization sessions were conducted. During generalization sessions, the instructor and conversation partner were present in the appropriate mock store. No programmed consequences for interactions were delivered

during generalization sessions. The conversation partner, however, modeled appropriate conversational statements in response to each interaction emitted by Rand. No scripts were ever used with generalization stimuli. Generalization sessions were conducted after at least every seventh script-fading session.

Experimental Design

A multiple-baseline-across-settings experimental design was used evaluate the effects of the intervention package (Baer, Wolf, & Risley, 1968). The intervention package used scripts, script fading, and reinforcement for appropriate interactions (Krantz & McClannahan, 1993; Krantz & McClannahan, 1998; Stevenson, Krantz, & McClannahan, 2000). Rand was prompted to record points on his mechanical counter for each scripted or unscripted interaction that he emitted during script-fading sessions. These points were exchanged, after each session, for a preferred snack. The intervention package was introduced serially for each setting. Generalization to the generalization stimulus sets was measured at least every seventh session throughout the study.

Data Analysis

The data from each session were summarized by reviewing the video recording and scoring each utterance as a scripted interaction, an unscripted interaction, or a generalization interaction. The data were then summarized as the number of scripted interactions, the number of unscripted interactions, and the number of generalization interactions per minute. Scorers were allowed to review each recorded interaction a maximum of five times.

Interobserver Agreement

Two observers scored a sample of the videotaped sessions. Each observer independently scored each interaction as a scripted interaction, an unscripted interaction, or a generalization interaction. Independence of the scorers was obtained by having them score the tapes at different times. Prior to scoring the videotapes, pairs of scorers were trained using videotapes made during a pilot study. They were trained until they achieved at least 80% interobserver agreement on each measure in a single session. Training was conducted by having the observers review the portions videotapes in which they disagreed about their scoring and discuss their interpretation of the discrepant utterances. After each training session another pilot session was independently scored by the two observers and then discussed. They repeated the training/scoring sequence until they met the 80% interobserver agreement criterion.

For the purposes of collecting interobserver agreement data each videotape contained a time track that indicated the running time within the session. For each utterance each observer recorded the time that the interaction began to the nearest second and the type of interaction. Interobserver agreement was assessed on a point-by-point basis. To be scored as an agreement both observers had to score an interaction as the same type of interaction and code the time within one second of the other observer. Interactions that were coded with different interaction types or that were not coded as occurring within one second of the other observer's time were scored as disagreements. The interobserver agreement percentage was calculated by dividing the number of

agreements by the number of agreements plus the number of disagreements and multiplying by 100.

Table A8 shows interobserver agreement data for Rand's performance in the pilot study. Interobserver agreement data were collected on 35% of Rand's sessions in the pilot study (7 of 20 sessions). As shown in the table, agreement on Rand's performance in the response-contingent modeling phase was 100% for unscripted interactions. No scripted or generalization interactions were recorded during interobserver agreement sessions in the response-contingent modeling phase so percentages of interobserver agreement could not be calculated for those variables. During the script-fading phase interobserver agreement averaged 100% for scripted and 83% for unscripted interactions. No generalization interactions were recorded in the interobserver-agreement sessions during the script-fading phase so interobserver agreement could not be calculated for generalization interactions. Interobserver agreement for Rand's mechanical counter use indicated 100% agreement during session five. Interobserver agreement data were collected during the second reading pre-teaching session and showed 100% agreement between the two scorers. During the tenth session of stimulus pre-teaching, the two observers scored his performance with 100% agreement.

Results

Pre-teaching. Table A9 shows the mechanical counter, stimulus, and reading pre-teaching data for Rand. As shown in Table A9, during the initial session of pre-teaching the use of the mechanical counter Rand did not press the button on his mechanical counter during any of the trials. After five pre-teaching sessions, Rand was able to press

the button on his mechanical counter on 100% of trials. Rand only required two pre-teaching sessions to learn to read each of the 104 words correctly. Initially Rand was able to correctly label 80% of the stimulus items during stimulus pre-teaching. Stimulus pre-teaching continued for 10 sessions. During the tenth session, Rand achieved 100% accuracy in labeling the 60 stimulus items.

Interaction Data. Figure A1 shows Rand's interaction data from the pilot study. Sessions are shown on the abscissa. The ordinate indicates the number of interactions per minute. The solid line between sessions 8 and 9 indicates a condition change from the response-contingent modeling phase to the script-fading phase. Successive fading levels are indicated by numbered arrows along the top of each panel. The filled circles indicate unscripted interactions. The open squares represent generalization interactions and the open circles indicate scripted interactions. The three panels of the figure include data from the convenience-, video-, and sports-store settings.

As seen in Figure A1, in the convenience-store setting, during the response-contingent modeling phase, Rand's unscripted interactions were near zero. With the introduction of the script-fading intervention, beginning at session 9, Rand's scripted interactions increased to a maximum of 15 interactions per minute over 5 sessions. Script fading, in the convenience-store setting, began during session 13. Rand's rate of scripted interactions remained high during fading levels 1 through 3. As shown in Figure A1, with the introduction of the script-fading intervention unscripted interactions increased to 7 interactions per minute. They then dropped to near zero levels over the next three sessions. Unscripted interactions began increasing during session 14 when fading level 2

was implemented. Over the next two sessions the rate of unscripted interactions increased to 15. Unscripted interactions, however, returned to baseline levels when fading level 5 was reached during sessions 17 and 18.

During the response-contingent modeling phase no generalization interactions were made by Rand. In addition, during the script-fading phase Rand never emitted any generalization interactions. Scripted, unscripted, and generalization interactions remained at near-zero levels during the response-contingent modeling phases in both the video- and sports-store settings. The pilot study was terminated after fading level 5 was reached in the convenience-store condition so the intervention was never implemented in the video and sports-store conditions.

Discussion

As can be seen in Figure A1 Rand's rate of interactions was zero for generalization interactions and near zero for unscripted interactions during the response-contingent modeling phase. With the introduction of script fading he reached a maximum of 15 interactions per minute over 8 sessions. When fading level 5 was reached, however, his performance returned to baseline levels. Rand was successful during the fading levels that were characterized by deletion of words from the scripts. The white cards that the scripts were printed on were removed at fading level 5. Rand's performance deterioration, then, coincided with the removal of the white cards. Additionally, he never emitted interactions during generalization sessions. No white cards were present during the generalization sessions. It was hypothesized that this failure to continue emitting interactions during script-fading sessions resulted from the salience of the white script

cards. After Rand's performance decrement at fading level 5 the pilot study was terminated and a second study was designed. A new fading strategy was developed that was designed to reduce the salience of the scripts. In addition, a new generalization strategy was programmed that was designed to promote generalization more successfully.

Table A1

Teaching Stimuli for the Mock Videotape Rental Store Used in the Pilot Study

Videotape	Script
All Dogs go to Heaven 2	"Dogs don't smile."
Antz	"This movie is about bugs."
Black Beauty	"That horse is big."
Cats and Dogs	"Check out the white Cat."
Gordy	"What's on the pig's neck?"
Hercules	"She is wearing purple."
The Lion King II Simba's Pride	"Lions are king of the jungle."
The Little Mermaid	"Stories about fish are great."
The Muppet Movie	"Kermit is wearing a hat."
Rugrats in Paris	"Cartoons are funny."

Table A2

Generalization Stimuli for the Mock Videotape Rental Store Used in the Pilot Study

Videotape
The Aristocats
Babe
Beauty and the Beast
The Black Stallion
A Bug's Life
Free Willy
The Great Muppet Caper
The Lion King
The Rugrats Movie
Scooby Doo's Greatest Mysteries

Table A3

Teaching Stimuli for the Mock Convenience Store Used in the Pilot Study

Snack Food	Script
Almond Joy® Candy Bar	"Coconut is chewy."
Fig Newtons®	"These have fruit."
Kit Kat® Candy Bar	"Chocolate tastes yummy."
Lay's® Potato Chips	"Potato chips are salty."
Mini Oreo® Cookies	"Little cookies are neat."
Reese's® Peanut Butter Cups	"Peanut butter is good."
Ritz Bits® Cheese Sandwich Crackers	"You eat the middle first."
Skittles®	"The red ones are best."
Snickers® Candy Bar	"Candy bars are sticky."
Wrigley's® Doublemint Chewing Gum	"Chewing gum is fun."

Table A4

Generalization Stimuli for the Mock Convenience Store Used in the Pilot Study

Snack Food
Butterfinger® Candy Bar
M&Ms® Chocolate Candies
Milky Way® Candy Bar
Mini Chips Ahoy® Cookies
Mounds® Candy Bar
Nutri-Grain® Bar
Nutter Butter® Cookies
Reese Sticks® Candy Bar
Ruffles® Potato Chips
Wrigley's® Spearmint Chewing Gum

Table A5

Teaching Stimuli for the Mock Sporting Goods Store Used in the Pilot Study

Sports Equipment	Script
Baseball Batting Helmet	"A helmet goes on my head."
Baseball Glove	"I love to play catch."
Bicycle	"Look at this small bike."
Football	"Passing the ball is easy."
Frisbee® Flying Disk	"It's hard to throw it."
Golf Club	"I'll take a shot."
In-line roller skates	"Skating is my favorite."
Tennis Racquet	"Hitting the ball is cool."
Water Bottle	"Exercise makes you thirsty."
Wrist Guards	"Wear these when you skate."

Table A6

Generalization Stimuli for the Mock Sporting Goods Store Used in the Pilot Study

Sports Equipment
Baseball Bat
Basketball
Bicycle Helmet
Dumbbell
Hockey Stick
Knee Pads
Skateboard
Soccer Ball
Tricycle
Velcro® Catching Paddle

Table A7

Fading Levels Used During Script Fading in the Pilot Study

Fading Level	Remaining Script Content
Level 0	Full script
Level 1	Last word removed
Level 2	Last two words removed
Level 3	All but the first word removed
Level 4	All words removed
Level 5	Script card removed

Table A8

Mean Percentage of Interobserver Agreement (IOA) and Number of Observations (n) for Rand's Performance in the Pilot Study

Interaction Type	Response-Contingent Modeling		Script-Fading	
	IOA	n	IOA	n
Scripted		0	100	91
Unscripted	100	1	83	25
Generalization		0		0

Table A9

Pilot-Study Data for Rand's Mechanical Counter, Stimulus, and Reading Pre-Teaching Data, Interobserver Agreement Data, and Number of Trials (n)

	Pre-Test		Post-Test	
Condition	% Correct	n	% Correct	n
Counter Pre-Teaching	0	25	100	25
Stimulus Pre-Teaching	80	60	100	60
Reading Pre-Teaching	99	104	100	104

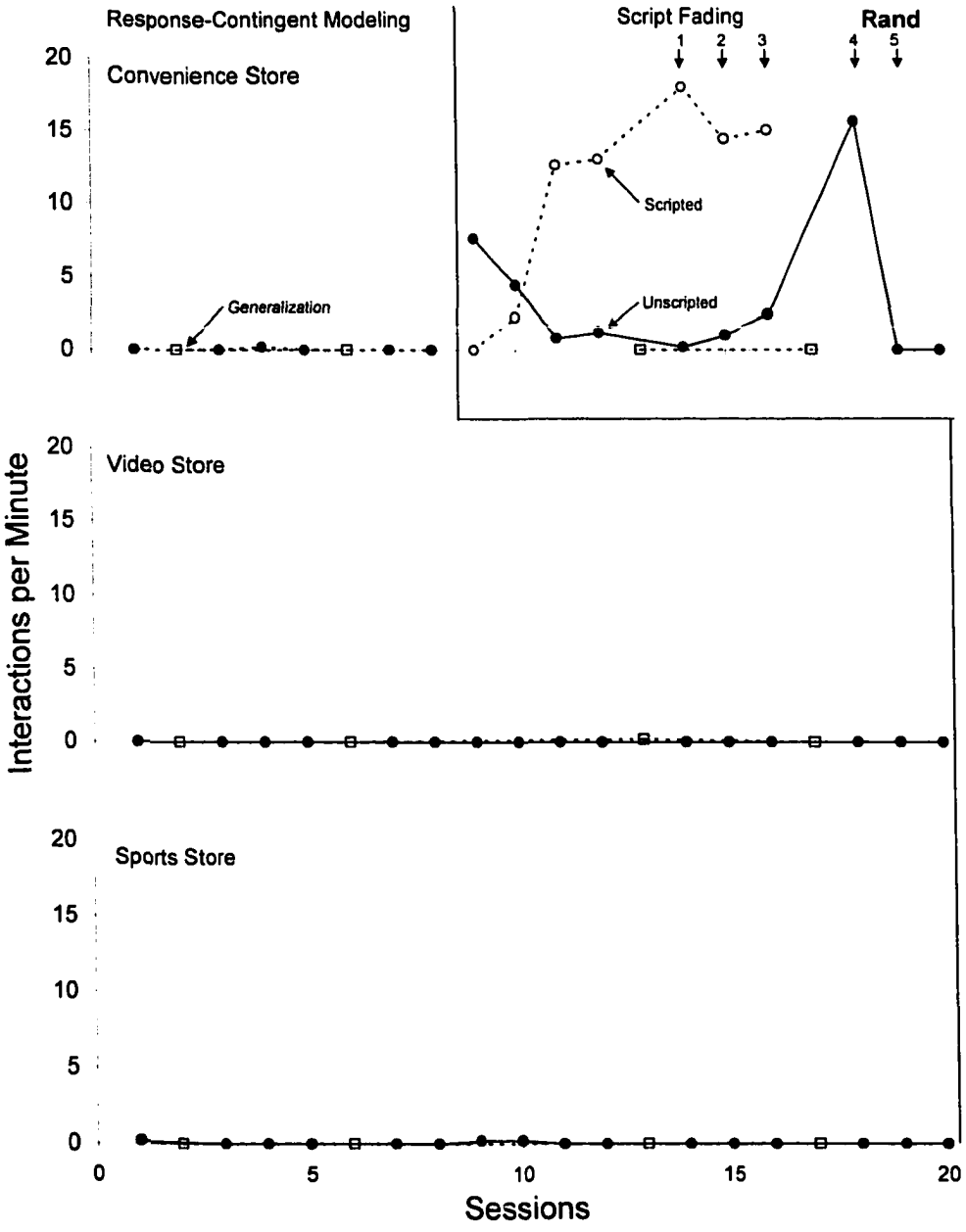

Figure A1. *Pilot-Study Data for Rand:* The number of scripted, unscripted, and generalization interactions across the response-contingent modeling and script-fading phases are shown for the mock convenience store. Data from only the response-contingent modeling phases are shown for the video and sports stores because the script-fading phase was never implemented in those mock stores. Fading levels are indicated by numbered arrows.

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