
SOCIAL INTERACTION SKILLS FOR CHILDREN WITH AUTISM: A SCRIPT-FADING PROCEDURE FOR NONREADERS

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Although children with autism often learn to answer questions and make requests, many do not initiate or pursue conversation with others. In this study, audiotaped scripts were introduced and then systematically faded to teach four boys with autism to converse with a target adult. A multiple-probe design across participants was used to assess the number of scripted and unscripted interactions during Baseline I, Baseline II, Teaching, and Maintenance phases. The intervention procedures increased unscripted interaction and the effects were maintained for 10–92 sessions. Previous research has documented the favorable effects of fading written scripts for children with reading skills. The current investigation demonstrates the effectiveness of audiotaped scripts and script fading for children with autism who are nonreaders. Copyright © 2000 John Wiley & Sons, Ltd.

Impaired social interaction skills are characteristic of children with autism. Spontaneous speech—speech that is controlled by nonverbal cues—is typically deficient or absent (Charlop, Schreibman, & Thibodeau, 1985). Often, language training begins with discrete-trial instruction that features verbal prompts, but reliance on verbal cues from others may produce a very limited set of stimuli to which youngsters can respond (Halle, Baer, & Spradlin, 1981; McClannahan & Krantz, 1997). Sundberg and Partington (1999) observed that the tight stimulus control established by discrete-trial drills may favor rote responding and inhibit spontaneous verbal behavior. Nevertheless, discrete-trial training is important, especially early in intervention, in order to establish attending skills and diminish responses incompatible with learning (Etzel & LeBlanc, 1979).

This dilemma is not easily resolved. Although incidental teaching and other naturalistic language-training procedures may promote generalized and spontaneous language use (McGee, Krantz, Mason, & McClannahan, 1983; McGee, Krantz, & McClannahan, 1985), the frequency of a child's initiations may limit

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the number of learning opportunities, and initiations may be absent when prepotent reinforcers are not visible or immediately available. Further, because incidental-teaching episodes evolve into discrete-trial training if the teacher requests too many elaborations, it may be difficult to achieve the give-and-take of ordinary conversation.

Thus, we are left with the question of how to help children with autism initiate and engage in communicative, reciprocal, turn-taking responses that continue for several turns, and that pertain to a shared topic (Chadsey-Rusch, 1991). Scripted conversations and script-fading procedures represent one effort to address this problem.

In an early use of scripts, Krantz, Zalski, Hall, Fenske, and McClannahan (1981) taught two five-year-old children with autism to answer questions about temporally remote events by rehearsing scripted responses. Answers to questions later posed at home were rehearsed at school, and answers to questions posed at school were rehearsed at home. A multiple baseline design across language tasks demonstrated that the children learned to provide as many as five unprompted answers to questions about events that happened at an earlier time, using sentences and paragraphs, but their descriptions of past events occurred only in response to parents' and teachers' questions.

In 1989, Charlop and Milstein used video modeling to present scripted conversations to three boys with autism, ages 6–7, who attended an after-school program. After training, the children's conversational skills generalized to different toys, unfamiliar persons, and different settings; further, unmodeled responses increased after video modeling was implemented. It may be noted, however, that conversations were not initiated by the boys, but by therapists, unfamiliar adults, or siblings who asked them questions.

Goldstein and Cisar (1992) used script training to teach three preschoolers with characteristics of autism and six children without disabilities to engage in appropriate social interaction. Triads (one child with a disability and two typically developing children) received training on one sociodramatic script at a time. The scripted nonverbal and verbal behaviors, taught with a most-to-least hierarchy of verbal prompts, were relevant to a carnival setting, a magic show, and a pet shop. Teachers, who did not observe script training, were asked to maintain stable rates of prompts and praise statements during free-play sessions before and after script training. The participants displayed increases in social and communicative interaction in each of the three activities only subsequent to training on each of the scripts. The investigators reported that the "use of the multiple baseline design demonstrated clearly that teacher prompting by itself did not result in improved social interaction" (p.278). Teachers' prompts—"reminding children what behavior had just occurred, whose turn was next, what

the theme was, and what their role was” (p. 269)—were present throughout the study, but teachers did not model scripted responses.

In 1993, Krantz and McClannahan used written scripts that were systematically faded from end to beginning to promote peer initiations. Four children with autism, ages 9–12, were taught to read and then say ten different scripts about recently completed, current, and future activities. Scripts were faded in five phases, from end to beginning, by deleting words. As scripts were faded, both unscripted initiations and responses to others’ initiations increased. Although there were only ten scripts, the children typically made many more than ten initiations per session and recombined elements of the scripts to produce new, unprompted and unscripted statements and questions. However, this use of scripts was limited to youngsters with reading skills.

In a more recent investigation, Krantz and McClannahan (1998) used script-fading procedures to increase the unscripted social interaction of three boys with autism (ages 4, 4, and 5 years) who had minimal reading skills. Prior to the study, the children were taught to read the words “Look” and “Watch me”, and during the teaching condition these textual cues were embedded in their photographic activity schedules. After they learned to use the scripts, the boys’ unscripted interactions and conversational elaborations increased, and these gains were maintained when the original recipient of interaction was replaced by a new recipient. The textual cues “Look” and “Watch me” were then faded from end to beginning by cutting away portions of the cards on which they appeared; after the final fading step, the children’s unscripted interactions maintained and then generalized to new activities that had never been the topic of teaching. This study and its predecessor (Krantz & McClannahan, 1993) documented promising procedures that enabled children with autism to initiate and participate in social exchanges without verbal prompts from adults.

Our previous investigations assessed the effects of written scripts. The present study was designed to examine the use of audiotaped scripts and script fading to teach conversational skills to young people with autism who were nonreaders. Interaction was never initiated by the conversational partner, and verbal prompts, instructions, and questions were not used.

METHOD

Participants

The participants were four boys who attended the Princeton Child Development Institute’s day school and intervention program for 5.5 h per

day, 5 days per week. All met the criteria for autism noted in the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; American Psychiatric Association, 1994) and autism was diagnosed by one or more outside agencies before they were enrolled. Informed consent was obtained from each participant's parent(s) prior to the study.

Rick, Mike, Brett, and John, ages 12, 15, 13, and 10 respectively, had been enrolled in the program for 7–12 years, and required continuous supervision and ongoing intervention. Age-equivalent scores on the Peabody Picture Vocabulary Test were 6–9 and 5–0 for Rick and Brett (Form L), and 6–2 and 2–7 for Mike and John (Form M). Age-equivalent scores on the Vineland Adaptive Behavior Scales were 4–8, 5–0, 4–0 and 3–2 for Rick, Mike, Brett, and John respectively.

The youths had acquired limited expressive language repertoires and had learned to mand (e.g., “I want drink”, “May I go to the bathroom?”); to greet others (e.g., “Hi, Mom”); and to use polite words and phrases such as “please” and “thank you”. When verbally prompted, they responded to instructions or questions with words, phrases, or simple sentences (e.g., “Apple”, “eat apple”, or “The boy is eating”, but they rarely engaged in spontaneous conversation, except to make requests.

Prior to the study, the boys had learned to follow photographic activity schedules (Krantz, MacDuff, & McClannahan, 1993; MacDuff, Krantz, & McClannahan, 1993), and one youth had learned to sequence his activities by choosing photographs from a display board and mounting them in his schedule. The participants used activity schedules throughout the school day and followed their schedules relatively independently, even when activities and materials were resequenced (McClannahan & Krantz, 1999).

Setting and Materials

The study was conducted in a 3 × 4 m classroom. A desk and chair were located in the center of the room; another desk was located below a display board and next to a bookcase. The recipient of interaction (a familiar teacher) sat in a corner of the room; a 2.5 cm tape line on the floor marked a distance of 1 m from her. Observers, separated by a moveable partition, were located in a corner adjacent to the recipient.

The materials used in this study were 25 nonsocial activities (e.g., handwriting worksheets, puzzles, and play materials such as Boggle Junior) and five social activities (Language Master cards). When the cards were placed in a slot in the Language Master (Bell & Howell, No. 1732B), previously recorded scripts were played. Social activities were represented by five photographs of Language

Master cards; because these photographs were identical, they did not suggest any particular content of conversation, but merely cued participants to approach the recipient of interaction and initiate interaction. Nonsocial activities were represented by photographs of specific academic and leisure materials, such as a picture of a vehicle puzzle or a picture of a tracing task. Photographs were encased in plastic baseball-card holders and attached with Velcro to a yellow foam display board. The 25 materials for nonsocial activities were randomly assigned to five groups and these groups were systematically rotated across sessions. Also, photographs depicting the five Language Master cards (the social activities) and five academic or leisure activities (the nonsocial activities) were systematically rotated across ten positions on the display board. In all conditions except Baseline I, an activity schedule book (a 15 × 18 cm binder containing ten yellow pages covered with plastic page protectors and with small Velcro circles in the center of each page) was placed on the desk below the display board.

Materials for nonsocial activities were located on a bookcase and the position of materials was systematically rotated across sessions. During Teaching, the Language Master and Language Master cards were placed on a legal-size clipboard on the recipient's lap. The order of presentation of Language Master cards was systematically rotated across sessions, thus changing the sequence of audiotaped scripts.

Pre-investigation Teaching and Assessment of Imitation Skills

Prior to the study, each youth received training on imitating four- and five-word audiotaped Language Master scripts (e.g., "I like your sweater", "Bob is a teacher"), none of which was used during the experiment. Training sessions occurred once per day and were discontinued prior to baseline. Each youth achieved at least 80% accuracy on imitating four- and five-word scripts before participating in the study. Rick met criterion first, and John was last to achieve criterion.

Dependent Variables

Interaction

Scripted 1, scripted 2 and unscripted interactions were defined as understandable statements or questions (i.e., verbal productions that included a noun or pronoun and a verb) that were not prompted by another person asking a question (e.g., "Where do you go to school?") or giving an instruction (e.g., "Say ——" or "Tell me about ——"). Statements or questions were scored as

interactions if they were directed to the recipient by using her name or by orienting the face toward her while standing within 1 m of her; and if they were separated from the participant's previous vocalizations by a change in topic (i.e., a change in subject or object). Interactions included statements or questions such as "I like candy", "Do you have a dog?" and "Pete plays Uno".

Scripted interaction 1 was defined as verbal productions that matched the most recently played Language Master script, with the exception that conjunctions, articles, prepositions, and pronouns could be altered or deleted (e.g., substituting "and" for "or", or dropping "the"); verbal tense could be changed; singular or plural endings could be altered; and the recipient's name could be added. Thus, "Do you have the pet?" was scored as scripted 1, although the script was "Do you have a pet?"; "You like to eat pizza" was scored as scripted 1 although the script was "I like to eat pizza"; and "Pete like to play Nintendo" was scored although the script was "Pete likes to play Nintendo". These rules were adopted because, prior to the study, it was noted that all four participants made frequent errors relevant to the correct use of conjunctions, articles, prepositions, pronouns, verb tense, and plurals.

The five scripts used in the study included the three examples noted above, as well as "What is your favorite food?" and "My school is PCDI". Scripts were selected because they identified topics of conversation and could serve as social initiations, because the participants could pronounce (or approximate pronunciation) of the target words, and because the boys' instructors reported that they comprehended the words included in the scripts.

Scripted interaction 2 was defined as statements or questions that matched a Language Master script (with the exceptions noted above), but not the most recently played Language Master card. Playing one Language Master script and then saying a script played earlier in the session or in a prior session indicated that a boy could now use a script that was not the most recently played to open or continue a conversation.

Unscripted interaction referred to verbal productions that differed from the scripts by more than conjunctions, articles, prepositions, pronouns, singular or plural endings, changes in verb tense, or the addition of the recipient's name. The statement "I like to eat spaghetti" was scored as unscripted because the script was "I like to eat pizza"; likewise, the question "Do you have a cat?" was unscripted because the script was "Do you have a pet?"

Non-interaction included a repetition (i.e., a participant repeated his question or statement verbatim or altered it only by adding the recipient's name); echolalic responses to the observers' audiotape or other ambient noise; and single words (e.g., "Candy"). Other verbal productions not scored as interaction were greetings and "good-byes" (e.g., "Hi, Ann" and "Bye, Ann"); polite statements

such as “Thank you”, “Excuse me”, and “Please, Ann”; responses to questions or instructions (e.g., “What?”, “Okay”, “No”, and “Yes I do”); and requests such as “I want bathroom” and “May I have a tickle?” These exclusions were adopted because the participants had already acquired skills in greeting people, using polite phrases, and manding. Although many such non-interactions appeared in conversation during the study (and were not discouraged), they were not scored as unscripted.

In addition, if a participant used a statement that included ‘understood’ nouns, pronouns, or verbs (e.g., “Nice talking to you”) and then immediately repeated the statement using the understood component (e.g., “It’s been nice talking to you”), the repetition was scored as non-interaction. Finally, verbal productions prompted by the teacher or the recipient of interaction were scored as non-interaction. These exclusions were adopted in order to achieve a conservative measure of unscripted interaction.

Measurement Procedures and Experimental Design

Number of interactions was measured using a **continuous event-recording system (in 1-min intervals)**, during which **observers recorded verbatim all verbal productions** that occurred when a participant’s face was oriented toward the recipient and he was standing within the taped area. Numbered scripts were listed at the top of the data sheet, and when a Language Master card was played, observers recorded the number of that script. An audiotape signaled each successive 1-min interval; at the signal, observers drew lines on their data sheets and began recording in the next interval. Observers also recorded whether social and nonsocial activities were prompted by the teacher (by engaging in verbal behavior, or using graduated guidance, spatial fading, or increased proximity) or by the recipient (by asking questions, giving directions, or using graduated guidance or spatial fading).

Transcribed responses were later scored as scripted 1, scripted 2, unscripted, or non-interaction. A multiple-probe design across four participants was used to evaluate levels of interaction during Baseline I, Baseline II, Teaching, and Maintenance.

Experimental Conditions

Baseline I

The recipient of interaction (a familiar teacher) and observers were stationed in adjacent corners of the room; they occupied these locations throughout the

study. During Baseline I, the instructor remained in a corner opposite the observers. Materials for five nonsocial tasks were present (thus, there was something for the youths to do and, potentially, to talk about), but activity schedule book, Language Master, and Language Master cards were absent.

In Baseline I and all subsequent conditions, the recipient observed a boy's activities, smiled when he oriented towards her, and remained continuously available for conversation. She was asked not to initiate interaction, give instructions, or ask questions, but to respond to a boy's verbal productions with comments that might be of interest to him, and then to wait expectantly. For example, if a boy said "My school is PCDI", the recipient might respond with a statement relevant to that topic, such as "Dad brought you to school today" or "You ride your bike at PCDI" or "Larry is your teacher".

Baseline sessions began when a participant entered the room and ended after 10 consecutive minutes. At the end of each session in this and all other conditions, the participant went to his usual classroom and engaged in a preferred activity. No programmed rewards were delivered during any session throughout the study.

Baseline II

Baseline II occurred under the same conditions as Baseline I, except that an activity schedule book with ten pages and a foam display board with photographs depicting five nonsocial activities were provided; as noted earlier, photographs and corresponding materials were rotated across sessions. Because the boys had previously learned to follow photographic activity schedules, this condition assessed whether a familiar structure of activities would promote social interaction. Baseline II was identical to the Maintenance phase.

Teaching

When Teaching began, all materials were present. The activity schedule book was on a desk, and the display board above the desk included five photographs of academic and leisure (nonsocial) activities; materials relevant to completing these activities were arranged on the book shelves. The display board also included five photographs of Language Master cards, and Language Master and cards were placed on a clipboard on the recipient's lap. This location was selected in order to promote approaching the recipient.

The instructor stood behind the participant and used graduated guidance to assist him in (a) opening the schedule book, (b) selecting a photograph from the

display board, (c) mounting the selected photograph on the page to which the schedule was open, (d) obtaining the depicted materials, (e) completing the activity (i.e., approaching the recipient, running a card through the Language Master, and saying the statement or question most recently played on the Language Master, or emitting the responses required to complete a nonsocial activity such as a worksheet or puzzle), and (f) returning materials to their original locations, returning to the schedule book, and turning the page. The instructor made every effort to use only the amount of guidance necessary to achieve correct responses. For example, if a boy did not reach toward the display board, his hand was guided toward the board, but not toward any particular stimulus; only if he did not then make a selection was he guided to select a photograph.

During subsequent sessions, graduated guidance was replaced by spatial fading; that is, the teacher gradually changed the location of manual prompts from hands to forearms to elbow to shoulder (Cooper, 1987); this prompt-fading procedure quickly enabled the boys to select their own sequences of activities. Next, spatial fading was replaced by shadowing, and then proximity to the participant was decreased. This most-to-least prompts hierarchy—graduated guidance, spatial fading, shadowing, and decreased proximity—achieved a relatively errorless teaching procedure.

In order to prevent errors, the instructor reinstated the previous level of prompting at which the participant was successful. For example, if the instructor was shadowing a boy and observed that he was about to make an incorrect response, such as beginning to reach toward materials that did not correspond to a photograph, she returned to spatial fading. If she was using spatial fading and noted that a participant who was about to turn a page of the schedule book was holding two pages rather than one, she returned to graduated guidance.

Similarly, the instructor returned to the prior level of prompting in order to correct errors. If she was shadowing and a boy made an incorrect response (e.g., returned materials to the bookshelf but put them on top of other materials, rather than in the empty space that they previously occupied), she returned to spatial fading; and if that was not sufficient to correct the error, she moved back to graduated guidance. If the instructor was using spatial fading and a participant made an error (e.g., poked holes in a worksheet rather than writing on it), she returned to a graduated guidance. Whether preventing or correcting errors, as soon as a youth's performance stabilized, prompts were again faded in the previously noted sequence.

The instructor was completely silent throughout Teaching, never using verbal prompts. If a boy ran a card through the Language Master and did not repeat the audiotaped script, he was manually guided to run the card through the Language

Master again (and again, if necessary). All four participants said target scripts after running cards through the Language Master one to three times (but typically one time), and verbal prompts were never required.

Throughout all conditions, the recipient of interaction responded to participants with elaborations of their statements or questions (e.g., if the participant said "Do you like pizza?" the recipient made comments such as "Yes, I like cheese pizza" or "Yes, I go to Pizza Hut"), but never gave instructions or asked questions. After recipient and participant had completed approximately four exchanges, the recipient modeled a closing statement such as "It's been nice talking to you", "Thanks for telling me that", or "Talk to you later". However, early in Teaching, all four boys began to use these statements, with the result that they terminated conversation soon after it began. Thus, in approximately two exchanges per session, the recipient used a continuation statement such as, "I'd like to tell you something else" or "I thought of another thing to tell you". Teaching sessions ended when a participant completed the five social and five nonsocial activities that constituted the activity schedule. Early in Teaching, when the boys were learning to follow the activity schedule and say the scripts, some sessions lasted as long as 15 minutes; by the end of this condition, sessions lasted 10 minutes or less.

Script fading began after at least one session in which no prompts were delivered during nonsocial activities, and after three consecutive sessions in which a participant said the Language Master scripts without prompts. Scripts were faded from end to beginning by deleting words (see Table 1), and, as they were faded, pictorial stimuli representing social activities were also faded by cutting away portions of the photographs of Language Master cards. Only one fading step was introduced in any session. In Step 7, when neither Language Master nor Language Master cards were present, the remaining portions of the pictorial stimuli were removed, leaving baseball-card holders with plain yellow backgrounds. Finally, in Step 8, baseball-card holders and half of the display board were removed; the remaining board showed only five nonsocial activities (exactly as in Baseline II).

Maintenance

Maintenance began after fading was completed and after three consecutive sessions in the Teaching condition in which no prompts were delivered. No prompts were delivered during Maintenance, and the instructor remained in a corner of the classroom. Sessions ended after a participant completed his activity schedule (10 minutes or less).

Table 1. Fading procedure

<i>Fading step</i>	<i>Recorded script</i> (e.g., "What is your favorite food?")	<i>Pictorial stimuli on display board</i> (Language Master card)
Step 1	Last word of scripts was deleted (e.g., "What is your favorite")	Five-sixths of depicted Language Master cards was visible
Step 2	Last two words of scripts were deleted (e.g., "What is your")	Two-thirds of depicted Language Master cards was visible
Step 3	All but first two words of scripts were deleted (e.g., "What is")	One-half of depicted Language Master cards was visible
Step 4	All but first word of scripts was deleted (e.g., "What")	One-half of depicted Language Master cards was visible
Step 5	Language Master cards were blank	One-third of depicted Language Master cards was visible
Step 6	Language Master and clipboard were removed	One-sixth of depicted Language Master cards was visible
Step 7	Language Master cards were removed	Pictures of Language Master cards were removed
Step 8	Scripts were completely faded	Empty baseball-card holders and one-half of the display board were removed. (The remaining half of the display board was the same as that used in Baseline II.)

Interobserver Agreement

Interobserver agreement was obtained for (a) the presence or absence of prompts, (b) observers' verbatim recording of participants' verbal productions, and (c) the number of scripted 1, scripted 2, unscripted, and non-interactions.

Prompted Responses

In-classroom observers recorded whether social and nonsocial activities were prompted or unprompted by the instructor. Interobserver agreement on the presence or absence of prompts was 100% throughout the study.

Verbatim recording of verbal productions

Independent observers in the classroom recorded a boy's verbal productions verbatim within 1-min intervals. Agreement on content of interaction was scored if both in-classroom observers sequentially recorded responses with matching nouns or pronouns (with the exception that singular or plural endings could differ) and with matching verbs (with the exception that verb tense could differ) in the same interval. A "slippage rule" pertained to any entry recorded as the

Table 2. Percentage interobserver agreement on verbatim recording of scripted interaction 1, scripted interaction 2, unscripted interaction, and non-interaction

<i>Participant</i>	<i>Scripted 1 Mean/Range</i>	<i>Scripted 2 Mean/Range</i>	<i>Unscripted Mean/Range</i>	<i>Non-interaction Mean/Range</i>
Rick	100	99/50–100	87/70–100	65/0–100
Mike	100/80–100	100	98/70–100	90/50–100
Brett	100	96/67–100	93/70–100	80/0–100
John	100	100	86/67–100	85/33–100

first interaction in the next interval. The slippage rule meant that agreement was scored for interactions that were not recorded in the same interval if matching responses were the last entry in an interval for one observer and the first entry in the next interval for the other observer. Agreement on non-interaction was scored if both observers recorded a response that did not include a noun or pronoun and a verb. Percentage interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements, and multiplying by 100. Interobserver agreement on verbatim recording of interactions was obtained for 75%, 66%, 51%, and 47% (mean 60%) of sessions during Baseline I, Baseline II, Teaching, and Maintenance respectively; these data are shown in Table 2.

Mean interobserver agreement on the three primary variables—scripted 1, scripted 2, and unscripted interaction—was at acceptable levels. Lower means and ranges for non-interaction matched the experimenters' informal observation that these verbal productions were often low volume and poorly articulated.

Number of Scripted 1, Scripted 2, Unscripted and Non-interactions

Independent observers coded completed data sheets to indicate whether transcribed responses were scripted 1, scripted 2, unscripted, or non-interactions. Data sheets contained a numbered list of all scripts used during the sessions and a list of all nonsocial activities present. In-classroom observers identified activities and scripts by writing the name of the activity or the number of the script in the left column of the data sheet; verbatim recording was done in the right column; and the number of each interval was written in the center column. Agreement on number of interactions required that independent scorers sequentially code the same type of interaction in the same interval. If two verbal productions were recorded on the same line, they were counted as two interactions if each contained a noun or pronoun and a verb (e.g., "I drink Coke. I like Coke."). In the case of two non-interactions written on the same line, they

Table 3. Percentage interobserver agreement on coding of scripted interaction 1, scripted interaction 2, unscripted interaction, and non-interaction

<i>Participant</i>	<i>Scripted 1 Mean/Range</i>	<i>Scripted 2 Mean/Range</i>	<i>Unscripted Mean/Range</i>	<i>Non-interaction Mean/Range</i>
Rick	100	88/0–100	97/80–100	89/85–100
Mike	97/75–100	100	98/75–100	95/90–100
Brett	98/80–100	95/0–100	96/75–100	97/93–100
John	95/75–100	99/75–100	96/0–100	88/80–100

were scored as separate productions only if they ended with periods, question marks, or exclamation points and if the first word began with a capital letter (e.g., “Coke. ’Bye”). Interobserver agreement on coding of interactions was obtained for 100%, 70%, 82% and 88% (mean 85%) of sessions during Baseline I, Baseline II, Teaching, and Maintenance respectively (see Table 3).

RESULTS

Figure 1 shows the number of scripted 1, scripted 2, and unscripted interactions scored for each participant in each condition, with the exception that scripted 1 is not shown after scripts were faded, because Language Master and cards were no longer present. During Baselines I and II, Rick, Mike, and Brett did not interact with the recipient. Three unscripted interactions (“Call people”, “I’m done”, and “Sit down with a chair”) were scored for John during the first session in Baseline I but no other interactions were scored for him in Baselines I and II.

In five to nine sessions, the youths’ performances met criterion for saying all five scripted statements or questions without prompts, after which fading began. Fading steps 1–8 were completed in eight sessions for Rick and Brett, and 11 sessions for Mike and John. None of the boys exhibited a scripted 2 interaction before the fifth fading step was introduced, and these remained comparatively low throughout the study. The mean number of unscripted interactions during teaching was 15 (range = 0–23) for Rick, 17 (range = 9–23) for Mike, 16 (range = 0–23) for Brett, and 13 (range = 0–27) for John.

During Maintenance, when no prompts were delivered, unscripted interaction remained high and stable; Rick made 15–35 (mean = 21), Mike made 16–26 (mean = 23), Brett made 20–31 (mean = 27), and John made 21–25 (mean = 23) unscripted statements or questions.

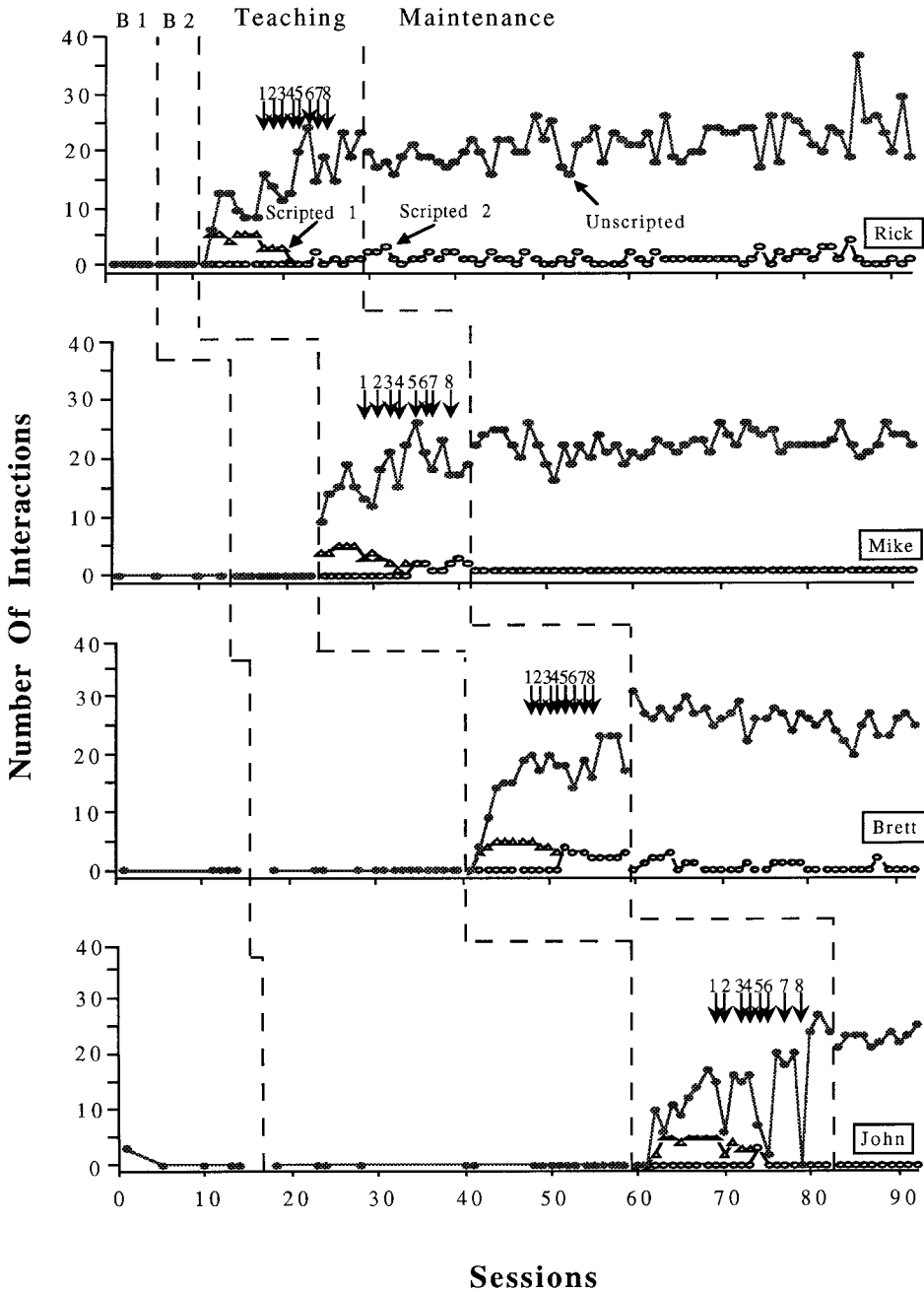


Figure 1. Number of scripted 1, scripted 2, and unscripted interactions by each participant during Baseline I, Baseline II, Teaching, and Maintenance conditions. Arrows 1–8 indicate fading steps.

No non-interactions were scored for Rick, Mike, or Brett during Baselines I and II. John's non-interactions ranged from 9 to 25 (mean = 12) during Baseline I, and from zero to 12 (mean = 3) in Baseline II. His non-interactions included verbal productions such as "Bus", "Cheese sticks", and "May I have a tickle?" The mean number of non-interactions recorded during Teaching was two for Rick (range = 0–15), four for Mike (range = 1–14), nine for Brett (range = 0–36), and 17 for John (range = 0–42). During Maintenance, the mean number of non-interactions was three, four, two and four for Rick, Mike, Brett, and John respectively.

DISCUSSION

Baseline data documented the participants' deficits in social interaction skills. During Baseline I, three of the four participants engaged solely in nonsocial activities. Rick selected one to three different nonsocial activities per session, and completed them at the desk. When a paper-and-pencil task was available, he consistently selected it and made marks on the paper as if coloring. During every session in Baseline I and II, Mike stood next to the instructor but said nothing. Brett selected a nonsocial activity and completed it (typically incorrectly) from a squatting position on the floor. When he finished the activity, he returned materials to the shelf, selected the same activity, and repeated this sequence for the duration of each baseline session. Although the recipient of interaction was present and attentive throughout baseline sessions, these participants never talked to her.

John interacted three times during Baseline I, session one, and also said several non-interactions. During six of seven sessions in Baseline I, and 11 of 17 sessions in Baseline II, he engaged in verbal behavior that was excluded from the definition of interaction, and most of these verbal productions were mands. For example, he said, "May I have tickle?" "(I want) Noogie", and "May I have squeeze?" When not making requests, he walked in circles around the room.

Aside from the first baseline session for John, none of the participants interacted with the recipient during Baseline I, when nonsocial activities were present, or during Baseline II when nonsocial activities and an activity schedule were present. Only after teaching began did the participants begin to use unscripted statements and questions.

In teaching, all participants mastered the five scripts in nine sessions or fewer. Rick and Brett completed the fading steps in eight consecutive sessions, and Mike and John had no more than one session between steps; thus, the teaching procedure was relatively time efficient. After the scripts were faded, Rick, Mike,

and Brett continued to utter a few scripted 2 responses. John ceased using the scripts after the fifth fading step. All participants said 15 or more unscripted statements or questions per session after script fading was completed. In addition, all four boys emitted 15 or more unscripted responses per session in Maintenance, when no prompts were delivered.

During teaching, the participants engaged in conversation on a variety of topics. Content analysis revealed that Rick and Brett had recurrent topics of conversation (e.g., going to McDonalds or watching movies), most of which were modeled by the recipient early in this condition; they altered scripted responses to engage in these unscripted interactions. For example, Rick changed the script "What is your favorite food?" to "What is your favorite movie?" and Brett changed the script "I like to eat pizza" to "I like to roller-skate".

As noted earlier, the recipient modeled closing statements after approximately four verbal exchanges. Thus, all four boys quickly learned to end conversations by saying "Bye" or making other types of closing statements, such as "Talk to you later" or "Nice talking to you". By the first session in teaching for Mike and John, and the second and third session for Rick and Brett respectively, the participants began to end conversations on their own initiative, usually before four exchanges had occurred. When this happened, the recipient sometimes used a continuation statement such as "I thought of something else". The pattern of ending interactions after only one or two exchanges may have been a result of the recipient's models, may have served as escape responses that terminated social interactions that the participants found difficult, or may simply underline the boys' severe conversational skill deficits. In retrospect, it may be important to provide more experience with conversation before modeling closing statements.

The boys' choices of social and nonsocial activities were measured after the third teaching session, and after each participant completed all fading steps (after sessions 41, 59, 83, and 92). Choice was defined as the number of social and nonsocial tasks completed when a participant was presented with ten social and ten nonsocial activities and a schedule that allowed him to select ten of 20 available activities. Observers recorded the number of social and nonsocial tasks completed, using a continuous event recording system in 1-min intervals.

Results varied by participant. Rick chose only nonsocial activities. Mike alternately chose nonsocial and social activities. In both assessments for Brett, he first selected five social activities and then five nonsocial tasks, an arrangement that he also consistently followed in teaching sessions. Finally, John picked eight nonsocial and two social tasks during the first probe and three nonsocial and seven social tasks in the second assessment. Interobserver agreement on number and order of social and nonsocial tasks completed was 100% for all participants in all sessions. The data on activity choice were idiosyncratic

across participants, and only Rick's choices implied a preference for nonsocial activities, the pattern that one might predict based on the definition of autism.

The measurement procedure was sensitive to participants' repetitions of their own statements and questions, but did not assess whether the recipient's responses were echoed. In order to examine echolalic responses, three Teaching and Maintenance sessions (sessions 61, 75, and 91) were audiotaped and scored by independent observers. One hundred percent agreement was obtained for transcribing and scoring audiotaped responses for all participants in each taped session. The analysis showed that Rick said 21, 20, and 28 non-echolalic statements or questions during the three taped sessions. Mike said five non-echolalic responses in each session, Brett exhibited eight, 11, and nine non-echolalic statements per session, and John produced five non-echolalic responses in each audiotaped session. Although three participants often echoed the recipient, they were, nevertheless, responding to her, practising turn taking, and practising statements that were sometimes used in later conversation.

Echoic responses may be functional in promoting the conversation skills of young people with autism, just as they have been shown to contribute to the acquisition, generalization, and maintenance of receptive naming skills (Charlop, 1983; Leung & Wu, 1997). Echoics frequently occur in infant vocalizations and in the speech of persons learning a second language (Pierce & Epling, 1995). It is not surprising that they are often observed in the speech of children with autism whose verbal repertoires consist primarily of mands, and who are making first attempts to engage in conversation about shared topics. Echoing another person's statement or question reinstates a stimulus (Bijou, 1993), perhaps facilitating the child's next response. Both anecdotal observation and transcriptions of audiotaped sessions indicated that participants not only repeated the recipient's statements, but also used them appropriately at other times, and in later conversation.

As the study progressed, the boys looked more competent as interaction partners; pauses before they initiated conversation and before they responded to the recipient's statements appeared to be of shorter duration. Like the parents of typical young children described by Hart and Risley (1999), the recipient "made effective the children's utterances that made sense, tolerated the mistakes of a novice, (and) modeled and demonstrated the skills to be learned . . ." (p. 186). Thus, the procedures used in the investigation set occasions for the participants to contact and practice many different models of appropriate, contextual language, and to practice conversational turn taking that was not interrupted by verbal prompts.

At the conclusion of the study, a new set of scripts was introduced in the boys' classroom. Social activities were embedded in their school activity schedules

(McClannahan & Krantz, 1999), and their regular teachers were trained to use the intervention procedures included in the study. For example, teachers who were recipients were trained not to ask questions or give directions, but to provide contextual language models and to fade scripts at relevant times. Classroom conversations were audiotaped and later transcribed and scored, and the definition of unscripted interaction was revised to exclude echoic responses; nevertheless, clinical data showed substantial increases in unscripted responses. In addition, four different recipients were often available, and it was noted that the youths quickly learned to seek out a different recipient if a particular teacher was busy, suggesting that their interaction skills generalized across persons.

Although the study did not formally measure generalization of social interaction skills across persons or settings, the assessment of unscripted interaction provided a different measure of generalization—the occurrence of target responses in training and nontraining conditions (Stokes & Baer, 1977). In Baselines I and II, Teaching, and Maintenance, interaction was assessed before, during, and after scripts were introduced and faded, and the data clearly show that after scripts were faded and prompts were absent, interaction continued at levels well above baseline.

It is difficult, in a journal article, to convey how the participants *sounded* when they conversed with the recipient. Did they sometimes sound stilted and robotic? The answer is unquestionably *yes* (and so do novice psychology lecturers, travellers to Paris who have just completed a beginning course in French, and many others who are learning new skills that require additional practice). If, instead of saying a script, a participant changed only a noun (e.g., substituted “Do you have a cat?” for “Do you have a pet?”) was that credited as unscripted interaction? Yes, it was. These participants were essentially silent during baseline; before the study, they did not initiate unless verbally prompted; and their age-equivalent scores on a measure of *receptive* language ranged from 2–7 to 6–9.

What did they sound like when they conversed with the recipient? As in previous studies (Krantz & McClannahan, 1993, 1998), we noted that responses that were initially imitative often reappeared in spontaneous, generative speech. For example, after saying the script, “Pete likes to play Nintendo”, Brett frequently imitated the recipient, who modeled statements such as “You like to go camping with Dad”, “You sleep in a tent”, or “You go to the museum”. After scripts were faded, Brett made unscripted contextual statements such as “I go camping with a tent”, and “I like to go to the museum with Dad”.

Building conversational language is a key issue in autism intervention. Although many young people learn to mand and to verbally respond to others’ instructions or questions, their expressive language repertoires often appear to be

under the control of very specific stimuli—verbal prompts from parents or teachers. The use of scripts and script-fading procedures may be helpful in achieving broader control by stimuli such as the availability of a conversation partner and the partner's comments. The use of audiotaped scripts makes these procedures available to young people who are nonreaders. Systematic assessment of the generalization of interaction skills to new settings, recipients, and scripts, and investigation of the role of echoes in the development of conversational skills, await further research.

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