Conditioned Observation of Books and Accelerated Acquisition of Textual Responding by Preschool Children

Hshin-hui Tsai and R. Douglas Greer
Columbia University Teachers College and Graduate School of Arts and Sciences

Abstract

We report an experiment investigating the effects of conditioning books as reinforcers for observing responses on the learning of textual responses by pre-school children. The independent variable was the acquisition of conditioned reinforcement of observing responses and choice of book stimuli in free play settings where children could choose to play with toys or look at books. Prior to the conditioning procedures, the children played with toys and did not look at books in free time in 4 preconditioning 5-minute free-play sessions. During the treatment we conducted simultaneous stimulus conditioning procedures until looking at books became the preferred free-play activity. The dependent variable consisted of the numbers of learn-units-to mastery of textual responses before and after conditioning books as reinforcers for observing responses. Three boys and one girl (ages 2 years and 9 months to 4 years) participated in the experiment in a pre and post learn-units-to-criterion and simultaneous matched-pairs design with a time-lagged component. Prior to reinforcement conditioning, we matched children in pairs based on learn units they required to master a sets of 5 counterbalanced word sets. One child in each of 2 pairs received book conditioning initially, and another child received an equal number of conditioning trials with toys, as a control conditions, and then book conditioning. The results showed that (1) all four children required fewer learn-units-to-criterion on textual responses after books were conditioned as reinforcers for choice and observing and those who received the book conditioning first performed best. (2) Three of the four children maintained preference for books at 33%, 83%, and 100% of time in free play probes at 1 month. (3) There were no maintenance effects on accuracy of textual responding.
Keywords: conditioned reinforcement, observing responses, preference, textual responding

---

Most early literacy theories concur on the importance of developing "positive literacy experiences" for young children by providing them with access to books and encouragement from adults (Neuman, 1999). They also agree on the importance of developing independent "reading-like" activity (i.e., book observation) as being important to children's subsequent reading repertoire (Holdaway, 1979, 1990). At least one research study reported that having opportunities to choose preferred activities, or preference for instructional activities, enhanced performance on such activity (Cooper Wacker, Thursby, Plagmann, Harding, Millard, & Derby, 1992).

While the importance of children "choosing to look at" and "enjoy books" as a "reading readiness" activity is almost universally held to be important, the lack of precision in definitions and measurements of choice, preference, and observation has led to few substantial findings in mainstream educational research on reading. It is not surprising then that the relation between interest in books and children's textual responding has not been examined experimentally using direct measures. Helpfully, Skinner (1957) characterized observation as an operant behavior selected out by the consequences of that which is observed, and Holland (1958) empirically demonstrated operant observing responses.

When books and related stimuli select children's attention and looking at books becomes a preferred activity during periods of free play, the book stimuli are conditioned reinforcers for observing and selecting books. Presumably, if looking at books is a preferred activity, children should learn to read more quickly. It appears that this theory has not been experimentally tested in the applied literature and there is little research in the basic science on the relation between

conditioned reinforcement for stimuli and discrimination learning (See Dinsmoor, 1983 for the exception).

The control of stimuli like those stimuli associated with books as reinforcement for looking at books is identified in the science of behavior as conditioned reinforcement of stimuli for observing responses (Dinsmoor, 1983; Greer, 1980) and the processes for conditioning stimuli involve both traditional operant and stimulus-stimulus pairing operations (M. Sundberg, Michael, Partington, & C Sundberg, 1996). In the behavioral pedagogical literature, the operations of reinforcement conditioning are the source for broadening a child's community of interests (Greer, 2002). This important area has received little attention in the basic or applied literature in the last two decades, but a significant number of studies are found in an earlier literature.

Laboratory instrumentation was developed in the sixties and seventies for measuring reinforcement as moment-to-moment control for listening or looking responses to auditory and visual stimuli (Morgan & Lindsley, 1966; Rheingold, Stanley, & Doyle, 1964). Various conjugate reinforcement apparati were used to test the reinforcement control of episodic stimuli. A conjugate apparatus is one that provides the necessary experimental control for measuring alternative stimuli such that location and other variables are controlled and allows the experimenter to assess responding as "free operant responding." Episodic stimuli such as music, speech, television, and motion pictures are stimuli in which the specific content varies from moment-to-moment—hence they are episodic (Cotter & Spradlin, 1971; Cotter & Toombs, 1966; Greer, Dorow, Wachhaus, & White, 1973; Lovitt, 1965, 1968). These procedures and instrumentation provided precise measures of the reinforcement control of observing responses as the relative duration that stimuli selected out observing responses.

This line of research led to numerous laboratory studies that resulted in a conditioning procedure whereby students were taught to prefer and to spend more free time with previously non-preferred episodic stimuli by stimulus-stimulus pairing procedures (Greer, Dorow, & Hanser, 1973; Greer, Dorow, & Randall, 1974; Greer, et al., 1973; Greer, Dorow, & Wolpert, 1980). More recently, this conditioning procedure and the use of substitute human observers has been used in applied research in which the use of conditioning toys or observing books functioned to replace stereotypy as a preferred activity (Greer, Becker, Saxe, & Mirabella, 1985; Nuzzolo-Gomez, Leonard, Ortiz, Rivera, & Greer, 2002). In addition to replacing stereotypy with appropriate play, by conditioning play responses to toys or observing responses to books, the procedures from these studies also introduced applied techniques and measures for conditioning books as reinforcers and procedures for observing responses and increased preference for books.

In the music conditioning studies and other conjugate reinforcement studies described above, the observing responses consisted of an assessment of listening that required the participants to maintain switch closures under laboratory free-operant conditions that resulted in measures of duration of selection or observation at the level of seconds. In the book conditioning procedure used herein, the target stimulus control for visual observing was attention to book-related stimuli (e.g., pictures, text) as determined by human observers using continuous 5-sec. observation intervals that is an applied measurement procedure for estimating duration. No prior research has tested for functional relations between conditioned reinforcement for observing book stimuli on children's learning to read. Indeed, other than the one participant in the Nuzzolo-Gomez et al. (2002) study no prior research has demonstrated the conditioning of book stimuli as conditioned reinforcement for observing responses.

In addition to using a measure of preference and reinforcement control of book stimuli for the implementation of the independent variable, we used measures of children's acquisition of

one component of reading, textual responding, as the dependent variable. Textual responding consists of speaking the printed stimuli (Skinner, 1957) and it is sometimes referred to as "see word and say word." In order to examine the relation between preference for books and children's acquisition of textual responding, an appropriate measure of the acquisition of textual responding was required. The use of the numbers of "instructional trials" required to achieve a predetermined criterion of mastery is a mainstay measurement of learning rate. The procedures used in conducting instructional trials varied significantly prior to the identification of learn units. The identification of learn units in recent decades provided a standardized and empirically based set of operations for instructional trials. Learn units are instructional trials that have all of the components of instruction that have been identified as necessary, if not sufficient, for the learning of new operants. The literature suggested that the numbers of learn units that children required to master a particular response is a tested and reliable predictor of the acquisition of operants (Albers, & Greer, 1991; Emurian, Hu, Wang, Durham, 2000; Greer, 1994; Greer, 2002; Greer & McDonough, 1999). Accordingly, we chose learn-units to a criterion as a measure of acquisition of the mastery of textual operant responses as our measure of rate of learning—the fewer the numbers of learn units to mastery the faster the rate of learning.

In the recent decades, some applied researchers have used "choice " to assess whether stimuli selected by individuals would act to reinforce other behaviors than the actual selection responses that were assessed (Deleon, Iwata, Conners, & Wallace, 1999; Piazza, Fisher, Hagopian, Bowman, & Toole, 1996). It is important to note that in operant research it is the stimuli that select out choice, not the individual who is selecting an observational response. It is important also to distinguish between the objectives of the reinforcement assessment studies and the objectives of our research. In the "choice" or reinforcement assessment studies, touching or selecting a stimulus served as the basis for determining whether the item selected would in fact act to reinforce another response or responses. In the present study, as in the music and toy conditioning studies (e.g., Greer, et al, 1973; Greer et al, 1985), the objective was to test the effects of certain stimuli on observing responses, not to identify possible reinforcers for other behaviors. That is we assessed, and then conditioned the reinforcer for stimulus control of print stimuli over observing responses.

Consistent with both the laboratory and applied literature on conditioning stimuli as reinforcers for observing responses, our book conditioning procedure consisted of the following features (1) insuring the children were observing and selecting books during training, (2) presenting adult praise and treats while the children were looking at books or selecting books during training sessions (the pairing procedure), and (3) assessing book observation in free play settings that approximated free operant conditions as a measure of when the independent variable was in place (i.e., conditioned stimulus control for observing and choosing books). The dependent variable consisted of pre and post-conditioning assessments of the numbers of learn units children required to master textual responses to sets of words.

The objective of the experiment was to determine whether the conditioning of book stimuli as reinforcers for choosing and looking at books would function to accelerate the rate of learning textual responses to words (i.e., decrease the numbers of learn units required to mastery). Our preconditioning probes showed that none of the children preferred books in settings in which they could choose between books and toys prior to the conditioning of book stimuli as conditioned reinforcement for observing, and none of the children had textual responses to words prior to the experiment.

Method

Participants

Four typically developing children, Child 5, Child 6, Child 7, and Child 8, participated in this experiment. Their ages ranged from 33 months to 48 months and the mean age was 41 months. Child 5's parents were originally from Mainland China, and Child 8's parents were from Hong Kong. Both families spoke their native languages (Mandarin-Chinese and Cantonese-Chinese) with their children at home, and the primary caregiver for both of them communicated in Mandarin-Chinese with them. Both Child 5 and Child 8 received daycare with the same caregiver in a private residential home. Therefore, their verbal repertoires in English were very limited. Child 5 was a 3-year-and-9-month old male. While he spoke mainly in Mandarin-Chinese, he could tact several common items in English. He could mand without using autoclitics in English. He also responded intraverbally and with tacts in some social situations (e.g., greetings, names, and apologies). His textual repertoire included saying all of the uppercase and lowercase alphabet letters when presented with the letters. According to Child 5's caregiver, Child 5 was read a short story book in Mandarin by the caregiver approximately once a week.

Child 6 was a 3-year-and-3-month old female, and Child 7 was 4-year-old male at the time they participated in this study. Both of them were from English speaking families and therefore had listener and intraverbal verbal repertoires in English. Child 6's textual behaviors included 21 uppercase and 10 lowercase alphabet letters, and Child 7 recognized 16 uppercase and 7 lowercase alphabet letters. Their English speaking preschool teacher reported that the children were read stories in a group and received both intraverbal and textual instruction on alphabet letters during school hours using standard preschool procedures of an eclectic nature. During the school day provision was made for individual reading times in which each child in the class was asked to choose one book to look at independently without any adult directions.

Child 8 was 2 years and 9 months old. He was from a Cantonese-speaking family. His verbal repertoires in Cantonese included listener, speaker, and intraverbal responses. Since his caregiver spoke Mandarin, Child 8 also learned to follow 5 common one-step commands and responded to yes or no when asked questions in Mandarin, and his speaker repertoires in Mandarin-Chinese were emerging. However, Child 8 had no verbal repertoires in English except textually responding to 24 uppercase and 20 lowercase English alphabet letters.

All four children were from upper-middle class families in which both of their parents were full-time professionals. Child 5 and Child 8 had been sent to the same caregiver's house during the day for two years. Child 6 and Child 7 were placed in a day care center from their infancy. Their parents volunteered their children for the study because they valued research and encouraged their children to take this learning opportunity.

Pre-treatment instruction on textual responding to English sight words was conducted, and the children were then matched based on the numbers of learn units each required to master a set of 5 words (See Table 1). None of them had textual responding to sight words prior to the instruction. Child 5 and Child 6 were matched as a pair, and Child 7 and Child 8 were matched as a pair.

Settings

The experiment took place in two settings—a private residential home for Child 5 and 8, and a private preschool for Child 6 and 7. Both settings were located in upper-class suburban areas. The study was conducted in a study room of the private house and in the conference room

of the preschool. Only the experimenter and the child were present in the room throughout the entire experiment.

The experimenter video-recorded all sessions with a camcorder that burned the elapsed time on the tape, including all conditioning sessions, free play sessions, and sessions involving instruction in textual responses. The camcorder was placed next to the child in the room. During free play probe sessions, several toy items and books were placed on the floor. At the beginning of these sessions, each child was told that she or he could either look at books or play with toys. The child was then directed to go to the play area where books and toys were available. The location of toys and books were systematically rotated between sessions. For the conditioning sessions, only the target conditioning items were present (either books or toys) on the floor. The child sat on the floor next to the experimenter and was instructed to attend to books (i.e., the experimenter said, "Let's look at books"). During the sight-word instruction, the child sat at a table facing the experimenter who presented individual flashcards to the child. For these sessions the experimenter presented the index card with the target words according to the procedures described below.

Response Definitions

Dependent Variable Responses. The dependent variable of this study was the numbers of learn units required to achieve the preset criterion on textual responses to sets of five words both before and after the acquisition of conditioned reinforcement for observing books. Learn units are: (a) instructional presentations by a teacher, experimenter, automated operant chamber presentation, or teaching device in which the antecedent stimulus presentation is unambiguous and the participant is attending to the antecedent stimulus, (b) the participant has an opportunity to respond (in our case this was a 3-secs intraresponse period), (c) correct responses are followed by reinforcement operations that have been shown to function as reinforcement for several learning and performance tasks in the participants history, and (d) incorrect responses are followed by a correction operation. The correction operation must include all of the following. (e) The student is provided the answer and (f) is presented the stimulus again, (g) after which the student is to provide the correct answer. (h) Corrected responses are not reinforced. A textual response to a learn unit presentation consisted of a vocal correspondence to a printed word. For example, when the student saw a textual stimulus "cat" and emitted the corresponding vocal verbal response "cat." All textual responding was taught in the visual and vocal form of English to all children. Criterion for mastery of the textual responses was 90% or better for two successive sessions. The words for each of the sets are shown in Table 1. Word sets were counterbalanced across students to control for word difficulty. The dependent variable was the numbers of learn units required of each student to meet the mastery criterion before and after the conditioning procedure.

Table 1: Sight Word Sets

Set 1	one, popcorn, hat, shoe, flower
Set 2	bow, three, seven, umbrella, truck
Set 3	eggs, pants, muffin, farmer, sweater

Set 4	pig, grapes, carrot, hamburger, rooster

Independent Variable Measures. The independent variable was the achievement of criterion for reinforcement conditioning or the acquisition of book stimuli as conditioned reinforcement for observing books during five-minute free play sessions. The five-minute free play sessions consisted of 60 continuous 5-secs. intervals. To meet criterion the child had to look at the books for 70% of the 5-secs. intervals out of 60 possible intervals for two consecutive sessions (separated by at least one day). Observation of books was measured in numbers of whole intervals of book observation in free play settings in which various books and toys were concurrently available to the child and the measure of choice was meeting the observing response interval criterion in the free play setting. A whole interval of book observation consisted of the child emitting book observation without distraction for the entire interval. Thus, in this study, book observation was defined as contact with or manipulation of books, including touching books, looking at books, turning the pages, pointing to pictures/textual stimuli, tacting pictures, and having textual responses to the text in the books. Of course, in order to meet the observation criterion, the children had to choose books over toys for the greater portion of the sessions. All books used in the experiment consisted of children's books with English printed words and pictures.

Control Toy Measures. As a contact control condition, two children, one in each pair, received the same conditioning procedures with toys, as did his/her pair with the books. Thus the pairing conditions were yoked or matched to the responses of the member of the pair receiving the book conditioning. Since all of the children chose and played with toys prior to the intervention, the students who received the toy conditioning procedure received additional conditioning experiences with toys. This provided an experimenter-contact control for the students who were simultaneously receiving book conditioning.

Data Collection

All free play probe sessions were videotaped, and at least 95% of the total book/toy conditioning sessions and textual instructional sessions were also videotaped. The experimenter and an independent observer recorded data for intervals engaged in toy play/book observation from the videotapes. The data on the number of approvals and correct/incorrect responses during toy/book conditioning sessions and instructional sessions for textual responding were recorded simultaneously with the implementation of these procedures to insure fidelity of treatment and recorded by an independent observer from the videotapes. The independent observers were blind to the nature of the experiment.

Conditioning procedures. The data collected throughout the conditioning procedures included (1) the numbers of verbal approvals delivered during training trials, and (2) the number of correct/incorrect responses during conditioning testing trials that were part of the conditioning procedure. Both types of data were recorded with pencil-and-paper by the experimenter while implementing the conditioning procedures. In the beginning of each conditioning session, a timer was set to a predetermined time period depending on the conditioning phase (e.g., 5 second, 10 second). During the training trials, the experimenter put a check mark for one count of verbal approval delivered to the child on the data record form. Two or three verbal approvals were delivered during a training trial, given that the child was continuously engaged in the target behavior. If the child discontinued the target behavior during training trials, the experimenter

stopped the timer and began the pairing trial again prompting the child to play or look at books respectively. Thus for a training pairing trial to be completed the student had to observe the book or play with the toys throughout the interval under the pairing conditions. Immediately following each complete training trial, the timer was set for a testing trial with the same time period as the training trial. During the testing trials, the experimenter observed the emission of the target behavior and recorded a plus (+) on the data sheet when the child was engaged in the target stimuli for the entire time interval and recorded a minus (-) when the child engaged in any other non-target behaviors during this time interval. A session consisted of 20 training and testing trials. The approval and periodic edibles were the conditioning stimuli and the book stimuli were the unconditioned stimuli for observing responses to book stimuli. The procedure is referred to as a stimulus-stimulus pairing procedure for conditioning operant reinforcers.

Free play choice probes. The time distribution on books and toys during free play choice probes was obtained from observations of videotape recordings of sessions. The data sheet was designed with 60 fill-in blanks of 5-second time intervals. According to the time burned on the upper right corner of the videotape, the experimenter observed the behavior emitted by the child for 5 seconds and paused the tape to record data. If the child was engaging in any book-related activities for the entire 5 seconds, a "b" was filled in the blank next to the time interval. If the child was playing with toys for the entire time, a "t" was marked. If the child was engaging in any other behaviors (e.g., paying attention to any other non-target stimuli), doing nothing, switching books to toys, or any discontinuation of the target behavior at any time during the 5-second interval, an "x" was marked. Also the primary and independent data collectors marked "x" in cases in which the child was searching for a book or a toy but was not engaging in any book observation or toy play behaviors for 5 seconds.

Interobserver Agreement

Interobserver agreement was obtained from observation of videotapes across all experimental conditions (see Table 4) by an independent observer who was blind to the treatment conditions. The agreements were assessed for 25% of the total experimental sessions from videotapes by a second independent observer. Five measures of interobserver agreement were assessed: (1) numbers of correct/incorrect responses during toy/book conditioning testing trials, (2) numbers of adult approvals during toy/book conditioning teaching trials, (3) numbers of intervals engaging in toy play or book observations during free play probes (baseline and post conditioning phases), (4) numbers of correct/incorrect responses on instruction of textual responding (baseline and post conditioning), and (5) numbers of correct/incorrect responses on maintenance of textual responses. Prior to assessing agreement, an independent observer who was naïve to the conditions of the experiment was taught to record data from the videotapes instruction in the definitions of behaviors and then conducted training observations independently until 100% agreement was achieved with the data observer on the numbers of correct/incorrect responses during conditioning testing trials, instruction on textual responses, and maintenance probes, and at least 95% agreement with regards to the number of adult approvals delivered during conditioning teaching trials and intervals engaging in toy play or book observations during free play probes. Once this was done, the second observer observed the tapes independently.

The interobserver agreement for correct/incorrect responses during book/toy conditioning testing trials was assessed point-to-point, and the percentage was computed with the number of agreements divided by the total number of agreements and disagreements multiplied by 100%. The mean agreement on correct/incorrect responses was 96.3% (range 90% to 100%) for book conditioning and 100% for toy conditioning.

Point to point agreement on the numbers of experimenter approvals delivered during conditioning teaching trials was calculated by dividing the smaller total by the larger total and multiplying by 100%. The mean agreement on adult approvals was 97% (range 94% to 100%) for book conditioning trials and 96% (range 91% to 100%) for toy conditioning trials.

The agreement on intervals of engaging in toy play/book observation during free play times was assessed with a point-by-point interval-by-interval method. We computed percentage of agreement by dividing the number of agreement intervals by the total number of agreement plus disagreement intervals and multiplying by 100%. The agreement for observation of books during free play ranged from 89% to 100%, with a mean of 98.%; the agreement for toy play during free play ranged from 80% to 100%, with a mean of 93.%. The lowest percentage agreement (80%) occurred in one session in which the experimenter recorded 5 intervals while another independent observer recorded 4 intervals for toy play.

The agreement on correct/incorrect textual responses during instruction and maintenance probes was assessed also on a point-to-point basis for responses to learn units. The percentage of agreement was calculated with the numbers of agreements divided by the total of agreements and disagreements multiplied by 100%. The agreement on instruction for textual responding ranged from 93% to 100% with a mean of 99%; the mean agreement for maintenance probes was 100%.

Experimental Design

We used a pre and post training learn-units-to-criterion design, with a simultaneous matched pairs treatment control condition, to test for a functional relation between the acquisition of conditioned reinforcement of observing books and choosing books on the children's learn-units-to mastery for textual responses to printed words (Kazdin, 1982; Johnston & Pennypacker, 1993). The design used features of a delayed multiple probe design also, and that feature will be described later. The independent variable was the acquisition of conditioned reinforcement for observing books that was defined as the child choosing books over toys and then observing books for a minimum of 70% of two consecutive 5-minute free play sessions (42 of 60 continuous 5-secs whole intervals) (Figure 3 and 4). The dependent variable was the numbers of learn units that the children required to master the textual responses to word sets, when mastery was set at 18 of 20 correct responses for two consecutive sessions, or 19 or 20 correct responses for one session (Figure 5 and 6). Students were matched into two pairs based on their learn units to criterion on the preconditioning baseline probes. One student in each matched pair was assigned the conditioning treatment for books and the other a toy conditioning procedure.

The treatment consisted of conditioned reinforcement training sessions (stimulus-stimulus pairing train and test trials, Figures 1 and 2) with probes in free play sessions until the data in the free plays setting showed that the treatment was implemented (i.e., the child chose and observed books for minimum of 70% of the time for two consecutive free play probes, Figures 3 and 4). The simultaneous treatment control component consisted of the provision of toy play conditioning for one of each matched pair of children, while the other child in each pair received the book conditioning. This provided a contact control treatment condition for the first phase. Probes on learn units to mastery for all four children followed this phase. Next, the two children who had received the toy conditioning control condition initially, received the book conditioning procedure and they were again probed on learn units to mastery for textual responses. The implementation of the book conditioning procedure for the children who had received the contact control condition in the first phase provided a time-lagged control for maturation and instructional history consistent with delayed multiple probe logic. That is the toy conditioning phase for the contact control students constituted a baseline condition for the subsequent book

conditioning intervention for those students. The word sets used in the instruction on textual responding were counterbalanced within each pair to control for word difficulty. Toy conditioning pairing trials for the contact control children in the first phase were yoked to the numbers of pairing trials required for student receiving book conditioning in each pair to acquire conditioned reinforcement for observing books; that is, the toy control child in each pair received the same number of pairings with toys as her or his book pair required to acquire conditioned observing for books. Finally, we conducted probes for maintenance of the conditioned reinforcement for observing books one month following each child's last mastery session for textual responses and we probed them for maintenance of accuracy for words mastered before and after the book conditioning treatment.

The sequence of conditions was as follows. (Step 1) Free play probes were done to determine initial preference and reinforcement stimulus control for books and toys for all four children. All children preferred toys and no intervals were devoted to observing books. (Step 2) We then tested the numbers of learn-units-to-criterion each child required for the mastery of textual responding to a set of words and the children were paired based on this measure. (Steps 3 and 4) Next, we introduced the book conditioning procedure for one child in each matched pair (Children 5 and 7) and the toy conditioning for the control child in each pair (Children 6 and 8). There were two steps in this process: (a) the children received the pairing training trials until they reached criterion for a specific interval of time and then (b) they were probed in free play to test if the training had been adequate. If the child did not meet the free-play criterion, the child was returned to the training procedure with an advancement in the length of the time intervals (i.e., 5 secs., 10 secs.) until the free play criterion was met for the book-conditioning child. The toy play child in each pair was returned to toy conditioning based on the responses of the book conditioning child with the numbers of pairing trials for the toy participants derived from, (i.e. yoked to) his/her matched pair's numbers of training pairings that he/she required to meet the reinforcement stimulus control training criterion (2 consecutive sessions at least 70% of the intervals). (Step 5) We then conducted post book conditioning instruction on textual responses for the first child and post toy conditioning textual instruction for the second child. (Step 6) Next, we conditioned books for Children 6 and 8 in the same manner as we did for Children 5 and 7, while conducting 1-month maintenance measures for book reinforcement control during free-play with the students who had received the book conditioning procedures. (Steps 7 and 8) We then conducted post-book conditioning sight-word instruction for Children 6 and 8 and a one-month probe for maintenance of textual responses for Children 5 and 7. (Step 9) Next, we conducted a one-month maintenance of reinforcement control for observing books for Children 6 and 8. (10) Finally, we conducted one-month maintenance probes for textual responding for Children 6 and 8 (see Table 2 for the sequence of the experiment). The outline of the sequence is shown in Table 2 and the details of each step in the sequence are described following the table.

Table 2: Sequence of Steps in the Experiment

Sequence	Children	Procedure
1	Child 5, 7 Child 6, 8	Free play baseline
2	Child 5, 7 Child 6, 8	Four sessions of learn-units-to criterion probes for 1 set of words. Children matched on numbers of learn units required to achieve mastery (Children 5 and 7 matched and Children 6 and 8 matched)
3	Child 5, 7 Child 6, 8	Book conditioning Contact control toy conditioning with pairings yoked to the book children
4	Child 5, 7 Child 6, 8	Free play probes following book conditioning with returns to training until the free play criterion was met Free play probes following toy conditioning, with returns to training yoked to the book conditioning pair
5	Child 5, 7 Child 6, 8	Instructions on textual responses for a set of words different than those for the preconditioning baseline
6	Child 5, 7 Child 6, 8	1-month maintenance free play probe for observing books and choice of books over toys Book conditioning procedure implemented as above
7	Child 5, 7 Child 6, 8	1-month probe on maintenance of textual responses Free play probes following book conditioning
8	Child 5,7 Child 6,8	Completion Instructions on textual responses for a different set of words
9	Child 5,7 Child 6,8	Completion 1-month maintenance free play probe
10	Child 5,7 Child 6,8	Completion 1-month probe on textual responses

Free play baselines

Free play baseline probe sessions consisted of four 5-minute free play sessions with toys and book items arranged on the floor of the experimental settings. Each child was directed to the pre-arranged play area and was told that he/she could choose any items that they would like to play with. The purpose of the free play baseline was to determine each child's pre-experimental choice of and observation of toys and books and the reliability of their choices. The location of books and toys was rotated between each session to avoid location effects.

Learn-units-to criterion probes

Each child was taught different sets of sight words. Any two out of the four children who required similar numbers of learn units to master one set of sight words were matched as a pair. These sight word sets were arranged in a counterbalanced order within each pair to control for word difficulty. That is, if Set 1 and Set 2 were taught to Child 5 prior to and after book conditioning, respectively, Child 6 (the matched counterpart for Child 5) was taught Set 2 during baseline and Set 1 after book conditioning. Therefore, if a child achieved criterion on textual responding with fewer numbers of learn units after book conditioning, it was because of the effects of book conditioning, not because one set of sight words was easier than another. There were two book/toy pairs in the study (Children 5, 6, and Children 7, 8). Children 5 and 7 were exposed to book conditioning only, while Children 6 and 8 (the counterparts for the other two children) were exposed to matched toy conditioning and then to book conditioning. Pre and post learn units to criterion for textual responses served as the dependent measure for the effect of acquisition of conditioned reinforcement for observing book stimuli and choosing books.

Book conditioning procedures for conditioning reinforcement for observing and choosing books

Each session of book conditioning instruction had 20-trial pairs of training/testing trials. Each trial consisted of two components—one stimulus-stimulus pairing training trial (reinforcement paired with observing books, and one test trial in which no pairings occurred). The length of each training/testing trial varied as the training progressed. We began at 5 seconds and added 5 seconds to the training sessions, if the child did not meet the reinforcement criterion in free play probe sessions (42 of 60, 5-second intervals or 70% of the 5-minute free play probe sessions following mastery of each of the interval training sessions). Each training trial involved stimulus-stimulus reinforcement pairings during periods when the child was observing the books for the particular interval being trained. Either two or three verbal approvals were delivered during a training trial alternated for each trial, while the child emitted book observation during that interval. One count of adult approval was defined as a positive verbal comment on the child's looking at books (e.g., "Good, I like the way you're looking at the books", or "Nice job pointing to the pictures!") Edibles were periodically delivered in conjunction with and paired with verbal approvals. However, if the child emitted any behavior other than observation of books, the experimenter stopped the timer and began the pairing trial again after the child was attending to the book. A training trial was not completed until the child met the criterion set for the sessions as described above. Different books were used for each session as a general case conditioning procedure.

The second component of the conditioning instruction was a test trial that consisted of an opportunity to look at or not to look at books. A test trial followed each training trial. During the test trials, adult approvals or any form of reinforcement was withdrawn. The child's responses on conditioning were recorded during this period of time. A correct response was defined as the child observing, touching, looking, turning pages, playing, pointing to pictures/textual stimuli, tacting pictures, or emitting textual responses to the text for the entire time interval under training. An incorrect response occurred when the child emitted any behaviors other than observing books (e.g., stopped looking at books and talked about irrelevant issues to the experimenter or searched for another book to look at for more than 5 seconds). When an incorrect response was emitted, a testing trial was terminated without any reinforcement or correction and the next pairing training trial opportunity immediately began. Train-test trials continued until 20-training/testing trials were completed. These are described in more detail below.

The book conditioning began with a 5-second intraresponse period for each training trial and each testing trial. If the child did not meet the free play criterion (that constituted the

measure of book stimuli as conditioned reinforcement for looking at books) following achievement of criterion in the training settings, the length of the training/testing trial conditions were increased in 5-second intervals (i.e., 5, 10, 15 seconds). This progression in interval durations continued until the free play criterion was met (70% of the total possible intervals, see Figures 1 and 2). It is important to note that as the duration increased, the reinforcement remained the same (e.g., the number of pairings for 10 secs. were the same as for 5-secs. trials). The twenty train-test trial conditioning sessions for each child were conducted at least one-day apart. The criterion for each book conditioning phase was set for 19 correct responses or better out of a total of 20-testing trial opportunities for two consecutive conditioning sessions.

Once the child achieved criterion for the conditioning training sessions, two 5-minute free play choice probes (see description below) were conducted the following day. The conditioning session and the subsequent free play probe sessions for each child were separated by at least one day throughout the experiment. If a child observed books for 42 intervals or more (70% of the total time intervals) for two consecutive free play probe sessions, the terminal goal for book conditioning was achieved, and the post conditioning sight-word instruction for a new set of words began. If a child did not meet criterion on free play choice probes, the child was returned to the training condition and the time requirement for the training trials was extended another 5-seconds. The time requirement for independent book observation in the conditioning testing trials was extended in this manner until the child met the terminal goal for book conditioning. It is important to note that when the time requirements were increased the numbers of approval or treatment pairings remained the same. Thus, a child who was on the 15-seconds objective still received either two or three pairings during each pairing trial.

Toy Conditioning Procedure

The toy conditioning procedure was identical to the book conditioning procedure except that the target stimuli were toys. Toy play was defined as any contact or manipulation with any toy item, including touching toys, playing with toys, and looking at and talking to toys. The procedure was a control condition for the independent variable to eliminate the possibility that simply pairing adult reinforcement with any activity might result in control over the child's independent choices for books or decreasing learn-units-to criterion for textually responding to words following the conditioning procedures. The toy conditioning time and the numbers of verbal approvals a child received were matched to his/her peer who was undergoing the book conditioning treatment. That is, Child 6/Child 8 received the same number of toy conditioning training/testing trials and verbal approvals as Child 5/Child 7 who were receiving reinforcement pairing for observing books. This procedure allows for the testing of increased reinforcement control of the stimuli for observing.

Free play choice probes—test of implementation of the independent variable

Free play choice probes consisted of measurement of the numbers of 5-second intervals (whole intervals) spent with books and toys during the 5-minute free play sessions. The procedures were the same as those done in the free-play baseline. A 5-second whole interval with books consisted of the child meeting the observing criterion for the entire 5 seconds without distraction. A count of a 5-second interval of playing with toys consisted of the toy play for the entire 5 seconds without distraction. If the child observed books/played with toys for only a portion of the interval (i.e., talked to the experimenter), or was passive during any part of the 5-second interval, such intervals were not recorded as toy or not book intervals. In these 5-minute sessions, various toy and book items were available to the child, and the child was encouraged to interact with any items independently. The positions of toys and books were rotated

systematically and sometimes interspersed within the play area for each session to control for the effects of location. Each 5-minute session was divided into sixty 5-second intervals to record the child's time distribution on toy and book items. The free play choice probes following conditioning sessions were conducted to determine when the terminal goal of the conditioning instruction was reached. That goal was for the child to be controlled by the target stimulus (e.g., books) in the conditioning instruction (i.e., did the book select out the child's observing responses?). The criterion for book conditioning was for the child to distribute 70% or more of the total intervals (42 whole intervals or more out of 60 intervals) for two consecutive sessions free play sessions.

One-month maintenance free play choice probes

The probes for maintenance of choice and observation of, books refers to the child's time distribution on the books in a 5-minute free play probe session one month after the child achieved the terminal criterion on book conditioning instruction. A single session of free play choice probe was conducted for each child one month after the child achieved the criterion on book conditioning. The one-month maintenance free play probes were conducted in the same fashion as the free play choice probes following book/toy conditioning sessions.

Instruction on Textual Responses—Dependent Variable

The performance on textual responding was measured by the numbers of learn-units-to criterion each child required for textually responding accurately to the words presented on flash cards. There were a total of 4 sets of sight words in this study. Each set consisted of 5 sight words selected from two of the most frequently presented books used in the book conditioning instruction and free play time. See Table 1 for the contents of each set of sight words. A general case instructional tactic was applied to sight-word instruction in which each word was presented with several variations in different fonts, scripts, and colors. Each variation of a sight word was printed on a 3x5 index card.

The sight-word instruction was delivered in the form of learn units (Emurian, Hu, Wang, & Durham, 2000; Greer, 1994; Greer & McDonough, 1999). As identified in the research literature, a learn unit consists of at least one potential three-term contingency for the student (i.e., the word is not yet a discriminated operant) and at least 2 three-term contingencies for the teacher. The completion of a learn unit required the teacher to obtain the child's attention, present textual stimuli to the child, and provide the child with an opportunity to respond. The teacher then immediately delivered reinforcement operations or corrections based upon the child's response. When an error occurred, the teacher implemented the correction procedure which consisted of repeating the correct word, having the child look at the word and say the correct answer, followed by no teacher consequence (Emurian et al, 2000; Greer 1994; Greer & McDonough, 1999). Each session of sight-word instruction included 20-learn units.

The instruction on sight words began with selection-based visual discriminations on printed words (i.e., point to responses to the teacher instruction, "point to ___"). During each discrimination instructional learn unit, the teacher presented two individual printed words on index cards placed on the table in front of the child along with the verbal antecedent "Point to ____ (the word)." One target word was presented with rotated non-target words. Several non-target words were rotated. If the child responded correctly, the teacher delivered verbal praise, edibles, or both to the child immediately. If the child responded incorrectly, the teacher performed the correction procedure by vocally or physically guiding the child to point to the correct textual stimulus and having the child repeat the correct response after hearing the teacher

say, "point to ___" again. Once the child achieved criterion accuracy on the selection discrimination, the instruction moved to textual responses to each individual word.

For the instruction on textual responding, the teacher presented no verbal antecedent but only one textual stimulus on an index card on the table for the child to emit textual behavior. Similarly, verbal praise, along with tangible reinforcers, was immediately delivered when the child emitted correct response. When an error response was made, the teacher vocally modeled the correct textual response in conjunction with the associated target textual stimulus, and the child vocally made a correction to complete that particular learn unit with no reinforcement from the teacher. Again, the sight words were individually introduced based on each child's progress. For example, if the child responded correctly for ten consecutive learn units within one session, a new word was added. The mastery criterion was 18 correct out of 20 for two consecutive sessions or 19 or better out of 20 for one session.

If the child responded with a textual response independently of the experimenter's prompt (i.e., before the experimenter said, "point to __"), the response was counted as correct, and the point-to component or selection component was not used. In this case, this selection learn unit was applied only in the first couple of learn units in the beginning discrimination session. For example, the first and second learn-unit presentations typically involved a target sight word along with a blank card, and the child was more likely to respond correctly. Also, the introduction of a new word in the discrimination task was selected in which the word's topography was largely different from the previously learned word(s). Since a correct response occurred when the child responded to an antecedent presentation independently, no prompt procedure was employed in this study. For example, when the child responded "I don't know" to a new textual stimulus presented for the first time, the teacher then vocally corrected the child to respond until the child corrected the response, but the response was still recorded as incorrect.

Maintenance of textual responses

Maintenance on textual responses consisted of the numbers of correct responses emitted out of a total of 20-non-consequated probe trials for a set of sight words the child had mastered one month earlier. Each set consisted of 5 sight words, and each word was presented in counterbalanced format for 4 trials during maintenance probe.

Results

Conditioning procedures and measures of the acquisition of conditioned reinforcement for observing

Figures 1 and 2 show the numbers of correct responses for testing trials under the conditioning procedure(s) for all four children. All four children displayed a high level of correct responses during conditioning procedures. Child 5 reached the ultimate goal of book conditioning in 7 book conditioning sessions, after the 15-second intraresponse conditioning period was implemented. Child 6 also responded to the matched toy conditioning trials with a high level of correct responses. Following the matched toy conditioning, Child 6 took 6 sessions (2 sessions each for 5-second conditioning, 10-second conditioning, and 15-second conditioning) to achieve the criterion performance on book conditioning. Child 7 also reached the criterion on book conditioning after 15-second conditioning sessions, and it took him a total of 8 conditioning sessions. Child 8 maintained a high level of correct conditioning trials under matched toy conditioning sessions. Child 8's book conditioning was completed after the criterion of 20-

second conditioning was performed. He required a total of 10 book-conditioning sessions to achieve the terminal criterion performance.

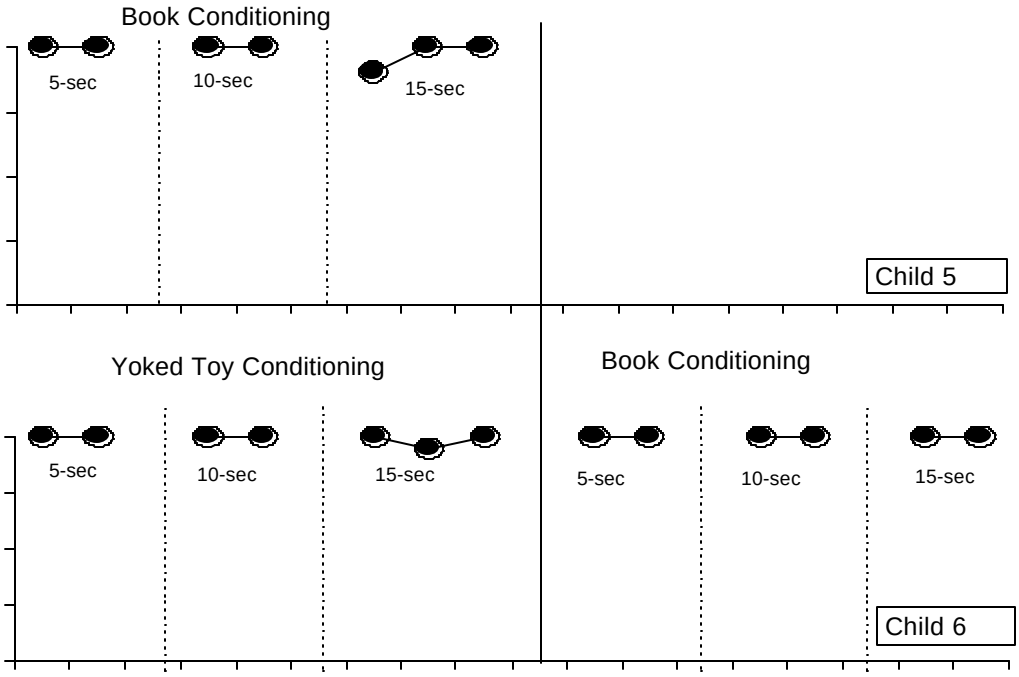

Figure1. The numbers of correct responses for testing trials under the conditioning training test trial procedures for Child 5 and 6

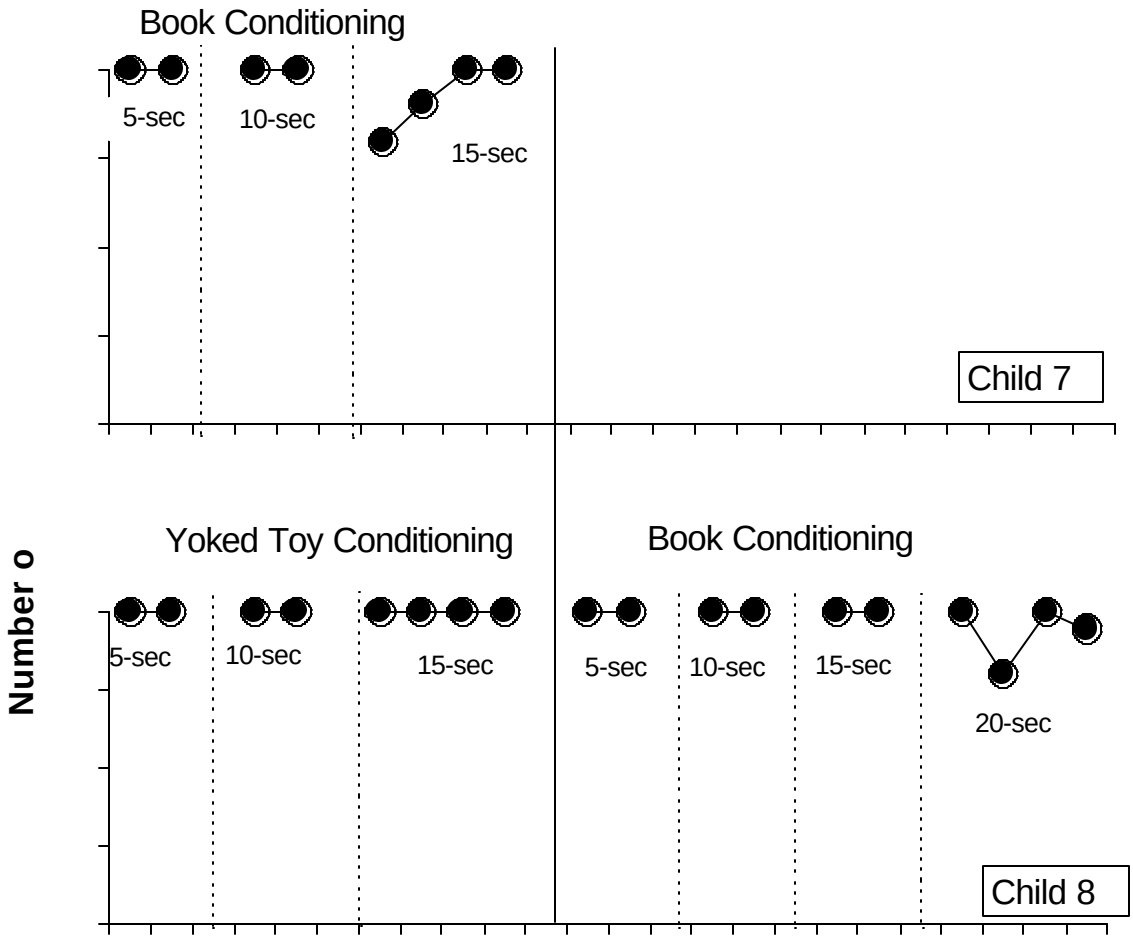

Figure 2. The numbers of correct responses for testing trials under the conditioning training test trial procedures for Child 7 and Child 8

Free play choice probes

Figure 3 and Figure 4 show the number of 5-second intervals in which the child was engaged in books and toys during 5-minute free play choice probe sessions (baseline, following each conditioning phase, and one-month probe). For Child 5, his baseline data showed that he spent the entire free playtime on playing with toys only. However, the free play probes after 5-second and 10-second book conditioning sessions displayed a variable trend with a variable increased level of time intervals on books and the corresponding decreased level of time intervals on toys. During the free play probes following 15-second conditioning sessions, Child 5 observed books for 56 and 60 in the first and second sessions, respectively, and played with toys for 0 intervals during both sessions.

Child 6 also spent all 60 intervals on toys during baseline free play sessions. Her free play probes following toy-conditioning sessions displayed the same pattern as the baseline, with a high level of toy play behavior and a low level or no book observation behaviors. The data

started to show crossovers during the free play probes following 5- and 10-second book conditioning sessions. She achieved the terminal goal for choice of books during free time after 15-second book conditioning sessions. In these two free play choice probes, she spent 55 and 56 time intervals with books and 0 intervals with toys.

Similarly, Child 7 played with toys for 60 intervals during all free play baseline sessions. The data showed an ascending trend with increased numbers of time intervals devoted to books across free play probes following three phases of book conditioning sessions. The time intervals on toys decreased to a medium level during free play sessions following 5- and 10-second book conditioning sessions and eventually decreased to zero occurrences in free play probes following 15-second book conditioning sessions.

Child 8 devoted all 60 intervals on toys and zero intervals to books throughout the baseline and the free play probes following matched toy conditioning phases. However, the overall trend for all free play probes following book conditioning sessions showed an ascending trend for the time intervals devoted to books and a corresponding descending trend for time intervals devoted to toys. The data on Child 8's free play probes after 20-second book conditioning sessions showed that he distributed 53 intervals on books and 0 intervals on toys for the first session and 43 intervals on books and 6 intervals on toys for the second session.

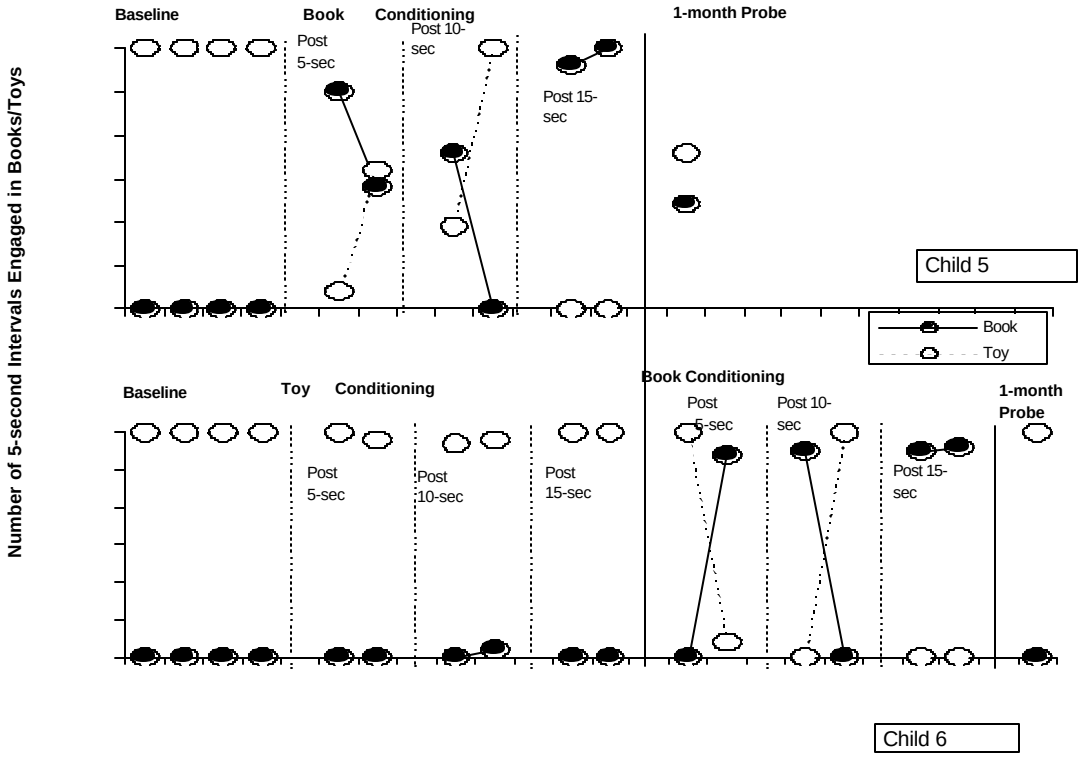

Figure 3. The numbers of whole intervals Children 5 and 6 engaged in observing books in free play probes

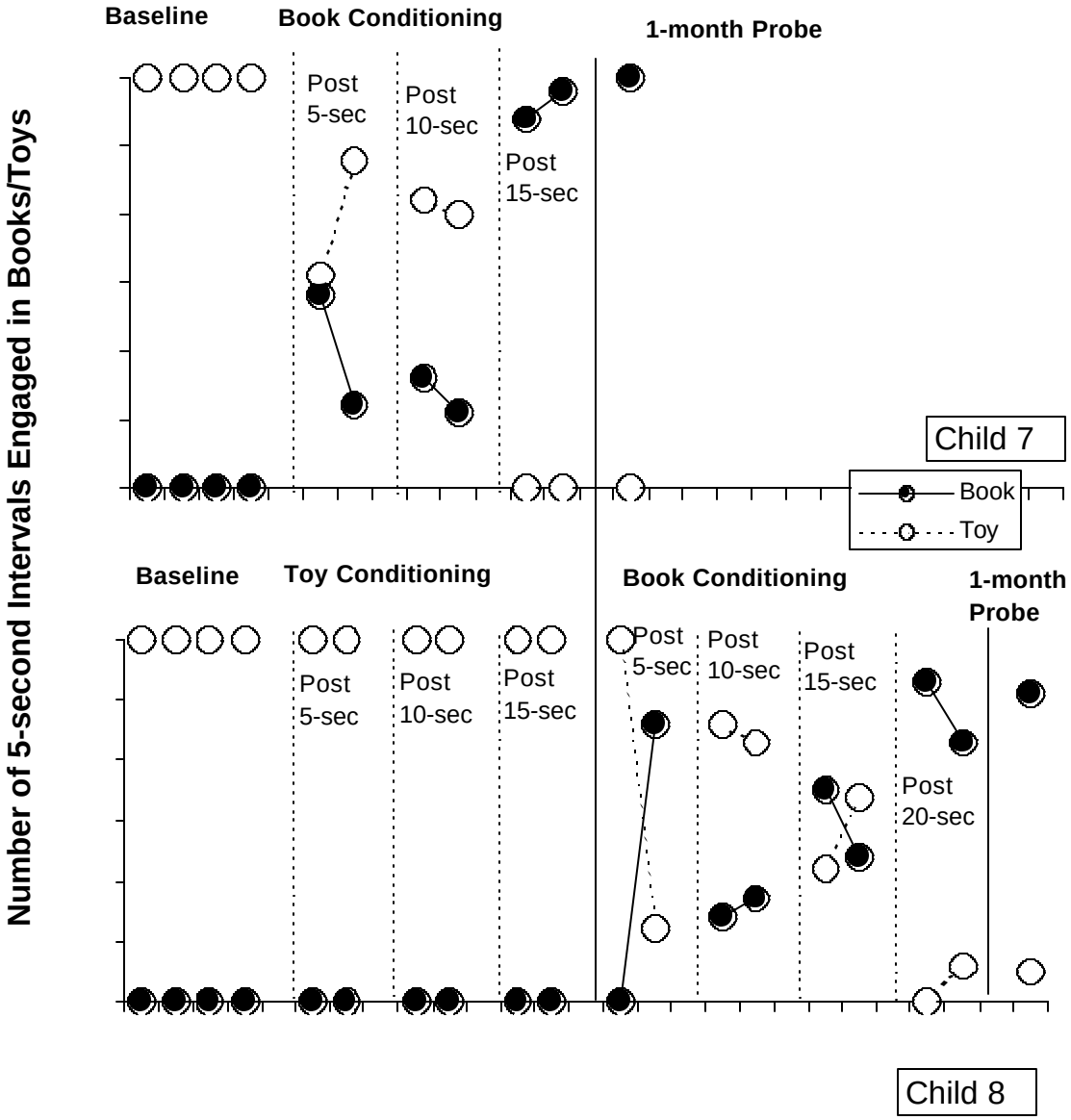

Figure 4. The numbers of whole intervals Children 7 and 8 engaged in observing books in free play probes

One-month free play choice probes—maintenance of choice and observation of books

As shown in Figure 3, Child 5's one-month free play probe showed that he looked at books for 24 intervals and played with toys for 36 intervals. His preference for books over toys was maintained at 33% of the intervals. For Child 6's one-month free play probe, she distributed all 60 intervals on toys and 0 intervals on books. She did not maintain conditioned preference toward books. Figure 4 also shows the one-month free play probe for Child 7 and Child 8. Child 7 continued to devote a high number of time intervals devoted to books (60 intervals) and zero intervals on toys during one-month free play probe. Similarly, Child 8 spent 51, 5-second

intervals on books (85% of the sessions intervals) and 5 intervals on toys. The data showed that 3 out of 4 children maintained the conditioned reinforcement stimulus control from 33% to 100% for books one month after they achieved the criterion for book conditioning.

Learn-units-to criterion on textual responses

Figure 5 and Figure 6 show the numbers of learn units required to achieve criterion on sight-word instruction before and after the book conditioning and the matched toy conditioning. Child 5 required 220 learn-units-to criterion on Set 1 (11 sessions) before book conditioning but required only 120 learn-units-to criterion on Set 2 (6 sessions) after the book conditioning procedure was completed. Following the book conditioning, Child 5 mastered the same number of sight words with 100 fewer learn units (5 sessions). Child 6 mastered Set 3 with 180 learn units (9 sessions) during baseline, Set 2 with 140 learn units (7 sessions) after toy conditioning, and Set 1 with 120 learn units (6 sessions) after book conditioning. For Child 6, the toy conditioning procedure decreased 40 learn units (2 sessions) to criterion, but the book conditioning procedure decreased 60 learn units (3 sessions) to criterion, compared to her learn-units-to criterion baseline. Since the 2 sets of sight words were arranged in a counterbalanced order between Child 5 and Child 6, the data for both children showed that the numbers of learn-units-to criterion were affected by the differences in treatment procedures (book versus toy conditioning) regardless of the difficulty level of the sight words taught.

Child 7's data on learn-units-to criterion showed a significant decrease in the total number of learn units after the introduction of the book conditioning procedure. It took him 400 learn units to master Set 4 (20 sessions) during baseline but 140 learn units for Set 2 (7 sessions) after books were conditioned as reinforcers. There was a decrease of 260 learn units (13 sessions). For Child 8, the learn-units-to criterion data showed that he needed 400 learn units to master Set 2 (20 sessions) during baseline, 560 learn units for Set 3 (28 sessions) after matched toy conditioning, and 360 learn units for Set 4 (18 sessions) after book conditioning. His learn units on post book conditioning sight-word instruction was 40 learn units fewer (2 sessions) than baseline and 200 learn units fewer (10 sessions) than post toy conditioning sight-word instruction. The between subject comparison also showed that the learn units required for Child 7 on post book conditioning sight-word instruction was significantly less than the learn units required for Child 8 on post toy conditioning sight-word instruction. The data for Child 7 and Child 8 also showed that the differences in the numbers of learn-units-to criterion were closely related to the experimental procedures and were not related to the difficulty of sight words because of the counterbalanced arrangement of the sight word sets.

The learn-units-to criterion data showed that the book conditioning procedure significantly decreased the numbers of learn units needed to master textual responding for all four children. Within each pair, the first child's learn units required for sight-word instruction after book conditioning was also significantly fewer than the second child's learn units required for the instruction after toy conditioning, given that the time and number of approvals during conditioning trials were matched. The data of the post toy conditioning instruction on textual responding also showed that the toy conditioning procedure slightly decreased the learn-units-to criterion for Child 6 but significantly increased the learn-units-to criterion for Child 8, indicating that the toy conditioning had an inconsistent effect on improving the children's learning on textual responding.

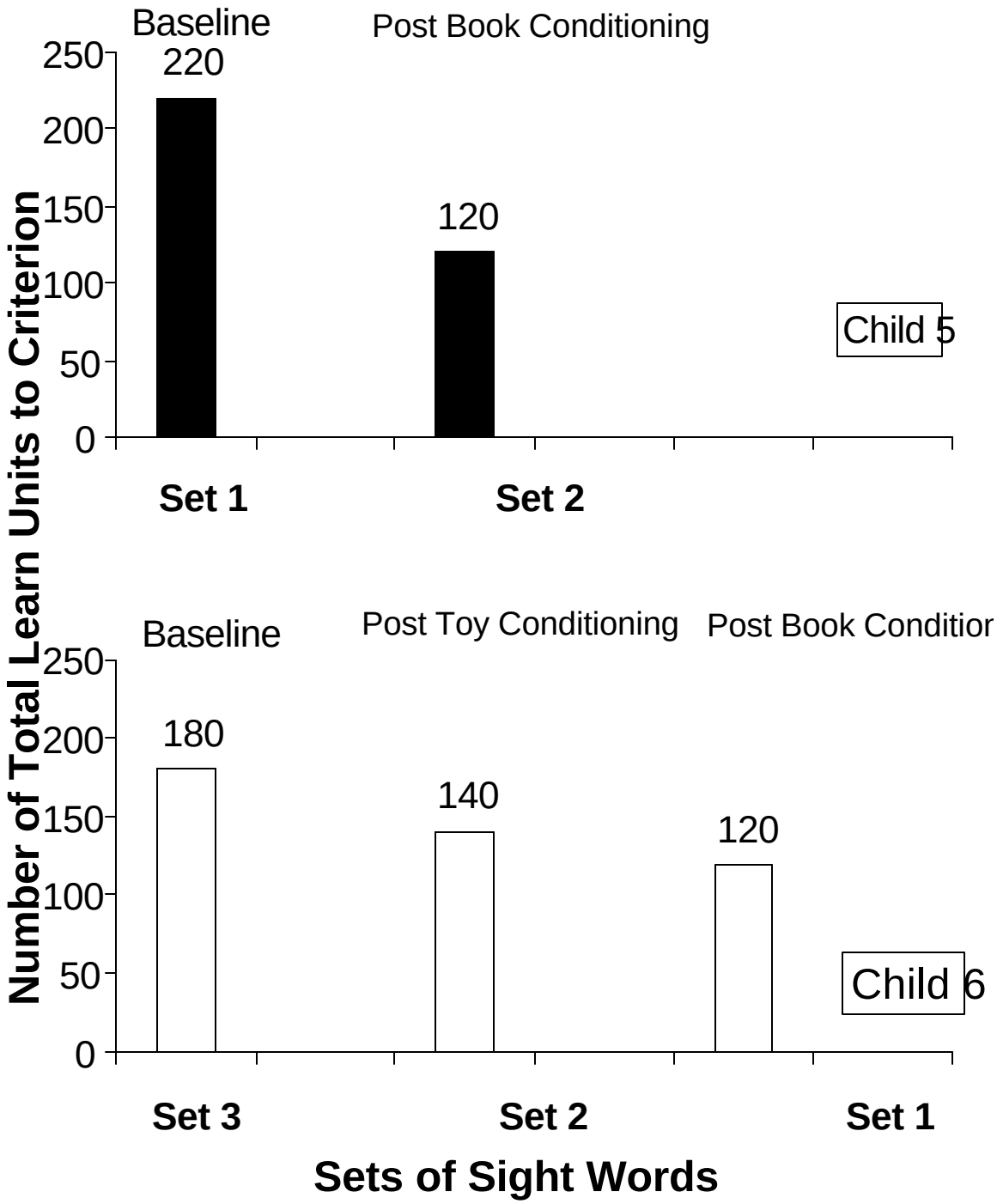

Figure 5: Learn-units-to criterion on Textual Responses for Child 5 and 6 before and after conditioning

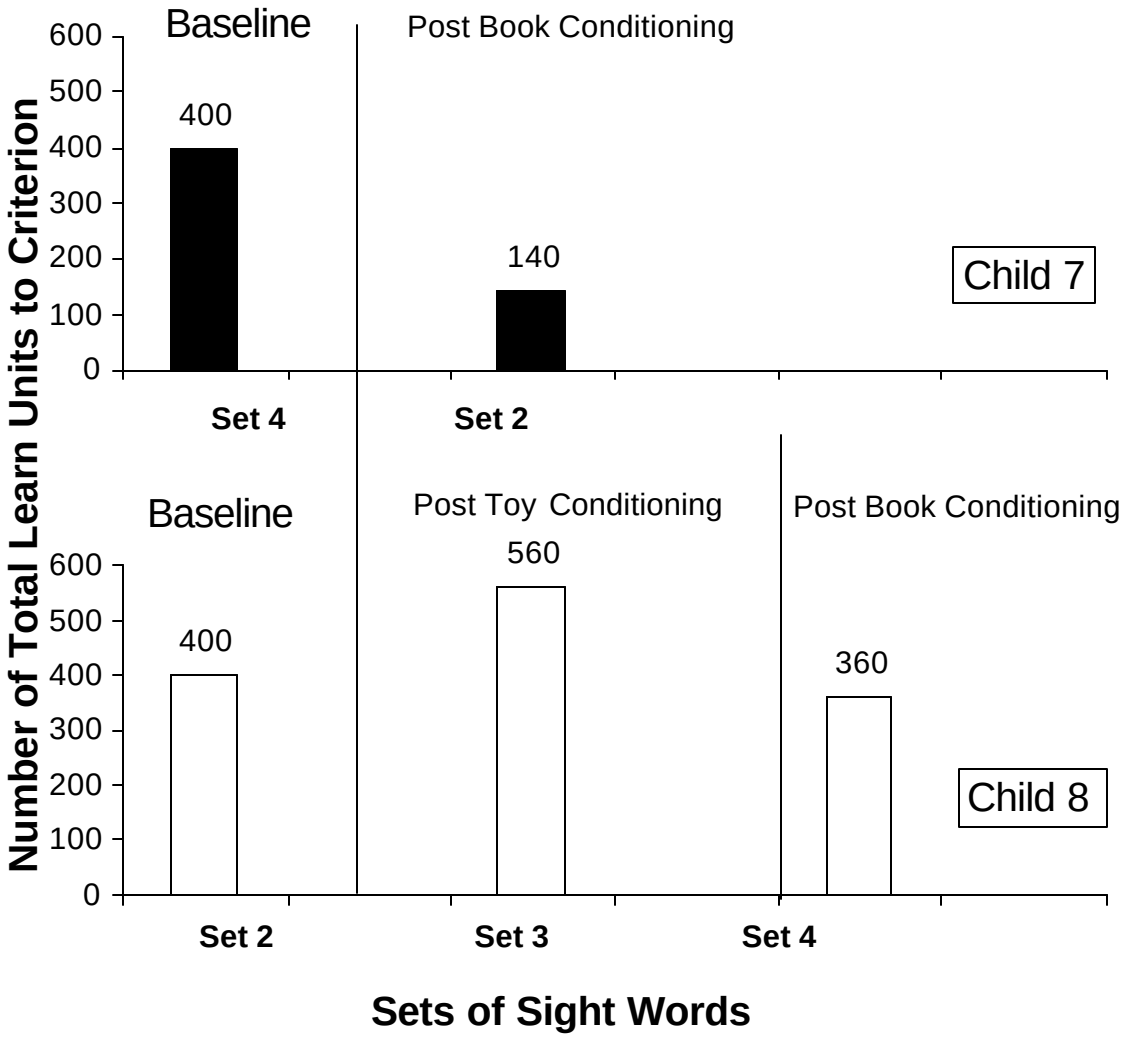

Figure 6: Learn-units-to criterion on Textual Responses for Child 7 and Child 8 before and after conditioning

Maintenance of textual responses

For the maintenance probes, Child 5 emitted 10 and 8 correct responses out of 20 opportunities for Set 1 and Set 2, respectively. Set 1 was taught in baseline and Set 2 was taught after book conditioning. For Child 5, words taught before and after book conditionings were maintained at a similar level. Child 6's maintenance data showed that she responded correctly for 9 out of 20 presentations on Set 3 (taught during baseline), 4 out of 20 on Set 2 (taught after toy conditioning), and 6 out of 20 for Set 1 (taught after book conditioning). Child 6's data showed that words taught during baseline and after book conditioning sessions were maintained better than words taught after toy conditioning. Words taught after book conditioning were not maintained better than words taught during baseline, showing that the book conditioning procedure did not make any difference on maintenance of textual responding.

Child 7 performed 9 correct responses out of 20 for Set 4 learned during baseline and 8 correct out of 20 for Set 2 learned after book conditioning. Both sets taught before and after book conditionings were maintained at approximately the same level. Child 8 emitted 4 correct

responses out of 20 for all three sets of sight words taught during baseline, after toy conditioning, and after book conditioning, respectively. The data for the maintenance responses are not displayed because of the lack of maintenance.

Discussion

The results of the experiment showed that the book conditioning procedure served to decrease the numbers of learn units necessary to achieve criterion accuracy on textual responding across all four children. That is, the learning rate for textual responses was increased by the induction of new reinforcement for observing book stimuli. The results also extended the findings of a similar study of Greer, Dorow, and Wolpert (1980) in which conditioning auditory observing control of music stimuli was functionally related to the decreased learn units to mastering complex auditory discrimination tasks for first graders. Conditioning preference for books may serve to enhance children's learning on textual stimuli in the following ways. First, the stimulus control was shifted to books, and therefore, the children spent more time on independent book observation during free-play time. Second, the increased time spent on books over toys increased the probability of eye contact with print stimuli associated with pictures in books. Third, the frequent contacts with print stimuli along with the corresponding pictures in books enhanced the control of print stimuli because the children were attending to the relevant stimuli.

In learning experiments, baseline conditions need to include alternate control interventions rather than no intervention. The toy play control condition was done to isolate print stimuli from possible conditioning effects for observing the experimenter in the textual instruction. Indeed, in one case observing the experimenter may have been an artifact of the toy conditioning. That is, following the toy conditioning procedures, Child 6 decreased his numbers of learn units to criterion suggesting that observing of the experimenter's instructions may have been conditioned also. However, for Child 8 the numbers of learn units to mastery actually increased following the toy play control conditioning. It was clear that the toy conditioning procedure did not have a positive effect on reading for Child 8. For Child 6, although the toy conditioning decreased by 40 learn units over baseline (a decrease of 2 teaching sessions), the book conditioning intervention reduced learn-unit-to criterion by another 20 learn-units. It is possible that the toy conditioning functioned to condition Child 6 to attend to instructions from the experimenter during the toy conditioning process.

The two children who received the book conditioning sessions only were older than the children who received the matched toy conditioning control sessions as a result of our initial control condition for matching students on textual learning rate. The age difference was a possible explanation for the fact that the children who received book conditioning learned better than their peers who received matched toy conditioning. The older of the pair who received the toy conditioning prior to the book conditioning achieved criterion for his word set in 140 learn units. However for the conditioning procedure, the youngest child, Child 8, required 7 sessions of pairing trials (140 pairing trials) to meet the free-play criterion, while child 7, the oldest child, required 8 sessions (160 pairing trials). The other two children required 5 and 6 sessions, respectively, to achieve the free-play criterion. The real differences in age occurred for textual responding in which the youngest child required 360 trials following book conditioning to master a word set, while the older children required 120, 120, and 140 learn units, respectively, to master their word sets after book conditioning. Thus, for one of the pair who received toy conditioning prior to the book conditioning condition, age, or more likely instructional histories, may have played a part. It is interesting to note that Child 8 had the lowest criterion level performance for the conditioning of books for observing. A more stringent criterion, say 90% of the intervals in 2

consecutive sessions may have produced stronger results. Future research needs to control for age and instructional histories more rigorously by limiting the age range and probing possibly related verbal capabilities such as naming, joint stimulus control across print and naming, and joint picture-print-word sound stimulus control (Greer & Keohane, 2005).

The data on the maintenance of textual responses showed little differences on textual responses learned before and after the acquisition of reinforcement value for books for all four children. This is not surprising since it is more likely that the pairings conditioned the stimuli for observing and this resulted in better observation to the stimuli and this, in turn, made learning textual responses occur more rapidly. However, the maintenance of textual responding requires other experiences such as the learning of many words with phonetic control and the development of comprehension before any benefits of conditioned observing are likely to accrue and these children had no such histories.

The children we studied included children from non-English speaking families. On the one hand this provided special control conditions for exposure to English. But, on the other hand this difference calls for further tests on English speaking children if we are to expand the generality of the procedures.

While the conditioning procedures were complicated they were thorough and can be done in everyday interventions by those who are trained in the use of the procedures. That is, these conditioning procedures have been used extensively in CABAS® schools for several years to provide reinforcers for behaviors that replace stereotypy (Nuzzolo-Gomez, 2002; Greer et al., 1985) and to condition book observing responses.

The design we used compared the effects of acquiring a new stimulus control over the learning of other stimulus control. Because it is a different type of design a few words of explanation are in order. In this and related studies on the effects of the acquisition of higher order operants or relational frames, the experimental design needs to address the effects of the teaching of new environmental stimulus control on either the emergence of responses not directly taught, learning rate, or acquisition of a different operant. In such studies it is first critical to demonstrate that a particular repertoire, capability, instructional history, or special stimulus control is not present. Next the missing stimulus control must be induced and the learning data on the process of acquiring the new missing stimulus control displayed. The relation of the dependent variable to the presence and absence of the newly created capability, repertoire, or higher order operant is determined by pre and post capability comparisons (Greer, Yuan, & Gautreaux, 2005, Greer, Stolfi, Chavez-Brown, & Rivera-Valdez, 2005; Singer-Dudek & Greer, in press). Thus, in the present experiment, the independent variable was not the toy conditioning procedures; rather it was the presence of a newly conditioned reinforcer for observing. Moreover, nested within the experiment is an experiment showing that the children acquired conditioned reinforcement for observing books as a function of the conditioning procedure further replicating the Greer et al. (1985) and Nuzzolo et al. (2002) findings as well as the series of studies on conditioning auditory stimuli. The conditioning procedure data show the slope of acquisition of stimulus control, but the free-play probes showed when the independent variable was in place. Our study addressed the branch of our science devoted to the relation of newly developed stimulus control relations to the acquisition of other stimulus control. The questions and methods of experimentation differ from studies showing, for example the acquisition of the stimulus control for reading comprehension as new operants where the treatment might be a particular tactic of instruction such as tutoring (Greer & Polirstok, 1982). In both of these cases, the learning of new operants and the learning of new capabilities, the effects are not reversible; however, what is learned and the source differs. In one case a new operant is learned by a

teaching tactic, while in the other a new capability, or in our case a new conditioned reinforcer for a behavior, results in an effect on other learning (i.e., in our case the rate of learning of textual responses). Both of the latter are learning experiments and differ from those studies devoted to the controlling variables for existing behaviors or performance (Greer, 2005; Greer, Singer-Dudek, Gautreaux, in press).

The effects of the intervention were powerful given the relatively few pairing sessions involved. That is, there are probably many more instances in the lives of many children where parents incidentally pair social reinforcement with looking at books. Such pairings occur incidentally over months and years with young children. It is very likely that these incidental pairing sessions, that occur as a matter of course in homes in which books are highly valued, play a key role in children's subsequent literacy. The fact that the acquisition of reinforcement for observing accrued in our case as a result of a relatively short intervention, especially for those children with minimal English language exposure, is impressive and probably due to the intensive application of conditioning procedures from the basic science. The numbers of train and test sessions required for the children to acquire reinforcement for observing and preferring books ranged from 5 to 8 sessions. Like the Greer et al. (1980) study where 2 year olds learned to prefer Bartok string quartet recording excerpts over children's music excerpts, the children in our study learned to prefer books over toys in a relatively short time. If these results hold, conditioning children to acquire conditioned stimulus control for observing books may pay real dividends in their subsequent acquisition of reading skills.

Reading readiness has been an imprecise construct in the literature on reading. Like age in the developmental literature, reading readiness has been an empty variable. However, if "reading readiness" is operationally defined as conditioned reinforcement for observing books, parents and well-trained educators can use these procedures to significantly enhance their children's future literacy. Reading readiness need not be relegated to non-empirically based assumptions about age; rather the readiness can be based on measures for each child. We would know that children are ready to read when books selected out observing responses in free play settings and the procedures we tested suggest how books can become conditioned reinforcers for observing. That is we know how to provide reading readiness. The results warrant future investigations to determine if these procedures constitute empirical measures of reading readiness. If five-year old children were taught to be relatively fluent readers who chose to look at books in free play settings by the time they entered school, the outcomes of schooling would be drastically improved.

References

Albers, A., & Greer, R. D. (1991). Is the three-term contingency trial a predictor of effective instruction? *Journal of Behavioral Education, 1,* 337-354.

Cooper, L. J., Wacker, D. P., Thursby, D., Plagmann, L. A., Harding, J., Millard, T., & Derby, M. (1992). Analysis of the effects of task preferences, task demands, and adult attention on child behavior in outpatient and classroom settings. *Journal of Applied Behavior Analysis, 25*, 823-940.

Cotter, V. W., & Spradlin, J. E. (1971). A nonverbal technique for studying music preference. *Journal of Experimental Child psychology, 11,* 357-365.

Cotter, V. W. & Toombs, S. A. (1966). A procedure for determining the music preferences of mental retardates. *Journal of Music Therapy, 3,* 57-64.

De Leon, I. G., Iwata, B. A., Conners, J., & Wallace, M. D. (1999). Examination of ambiguous preferences with duration-based measures. *Journal of Applied Behavior Analysis, 32*, 111-114.

Dinsmoor, J. A. (1983). Observing and conditioned reinforcement, *Behavior and Brain Sciences, 6,* 693-728.

Emurian, H. H., Hu, X., Wang, J., Durham, A. G. (2000). Learning Java: a programmed instruction approach using Applets. *Computers in Human Behavior, 16,* 395-422.

Greer, R. D. (1994). The measure of a teacher. In R. Gardner, III, D. M. Sainato, J. O. Cooper, W. L. Heward, J. Eschelman, & T. A. Grossi (Eds.), Behavior analysis in education: Focus on measurably superior instruction (pp. 225-248). Pacific Grove, CA: Brooks/Cole.

Greer, R. D. (1980). *Design for music learning*. New York, NY: Teachers College Press.

Greer, R. D. (2002). *Designing teaching strategies: An applied behavior analysis systems approach*. New York: Academic Press.

Greer, R. D., Becker, B. J., Saxe, C. D., & Mirabella, R. F. (1985). Conditioning histories and setting stimuli controlling engagement in stereotypy or toy play. *Analysis and Intervention in Developmental Disabilities, 5*, 269-284.

Greer, R. D., Dorow, L. G., & Hanser, S. (1973). Music discrimination training and the music selection behavior of nursery and primary level children. *Bulletin of the Council for Research in Music Education, 35*, 30-43.

Greer, R. D., Dorow, L. G., & Randall, A. (1974). Music listening preferences of elementary school children. *Journal of Research in Music Education, 21,* 345-354.

Greer, R. D., Dorow, L. G., Wachhaus, G., & White, E. (1973). Adult approval and students' music selection behavior. *Journal of Research in Music Education, 21,* 293-299.

Greer, & Polirstok, S. R. (1982). Collateral gains and short-term maintenance in reading and on task by inner-city adolescents as a function of their use of social reinforcement while tutoring. *Journal of Applied Behavior Analysis, 15*, 123-139.

Greer, R. D., Singer-Dudek, J, & Gautreaux, G. (In Press). Observational *learning*. *Journal of International Psychology*.

Greer, R. D., Stolfi, L., Chavez-Brown, M., & Rivera-Valdez, C. (2005). The emergence of the listener to speaker component of naming in children as a function of multiple exemplar instruction. *The Analysis of Verbal Behavior, 21,* 123-134.

Greer, R. D., Yuan, L. & Gautreaux, G. (2005). Novel dictation and intraverbal responses as a function of a multiple exemplar history. *The Analysis of Verbal Behavior, 21,* 99-116.

Holland, J. G. (1958). Human vigilance. *Science, 128,* 61-67.

Holdaway, D. (1979). *The foundation of literacy*. Sidney: Ashton Scholastic.

Holdaway, D. (1990). *Independence in reading (3rd ed.).* Portsmouth, New Hampshire: Heinemann.

Johnston, J. M., & Pennypacker, H. S. (1993). *Strategies and tactics of behavioral research (2nd ed.).* Hillside, NJ: Lawrence Erlbaum Associates.

Kazdin, A. E. (1982). *Single-case research designs: Methods for clinical and applied studies.* New York: Oxford University Press.

Lovitt, T. C. (1968) Free operant assessment of musical preference. *Journal of Experimental Psychology, 6,* 361-367.

Lovitt, T. C. (1965). *Narrative Rate preferences of Normal and Retarded Males as Assessed by Conjugate Reinforcement.* Doctoral dissertation, University of Kansas.

Morgan, B. J. & Lindsley, O. R. (1966). Operant preference for stereophonic over monophonic music. *Journal of Music Therapy, 50,* 493-496.

Neuman, S. B. (1999). Books make a difference: A study of access to literacy. *Reading Research Quarterly, 34,* 286-311.

Nuzzolo-Gomez, R., Leonard, M. A., Ortiz, E., Rivera, C. M., & Greer, R. D. (2002). Teaching children with autism to prefer books or toys over stereotypy or passivity. *Journal of Positive Behavior Interventions, 4,* 80-87.

Oldfather, P. & Dahl, K. (1994). Toward a social constructivist reconceptualization of intrinsic motivation for literacy learning. *Journal of Reading Behavior, 26,* 139-157.

Piazza, C. C., Fisher, W. W., Hagopian, L. P., Bowman, L. G., & Toole, L. (1996). Using a choice assessment to predict reinforcer effectiveness. *Journal of Applied Behavior Analysis, 29,* 1-9.

Rheingold, H. L. Stanley, W., & Doyle, G. B (1964). Visual and auditory reinforcement of a manipulatory response in the young child. *Journal of Experimental Child Psychology, 1,* 316-326.

Singer-Dudek, J., & Greer, R. D, (in press). A Long-term Analysis of the Relationship between Fluency and the Training and Maintenance of Complex Math Skills. *The Psychological Record.*

Skinner, B. F. (1957). *Verbal behavior*. Cambridge, MA: B. F. Skinner Foundation.

Sundberg, M. L., Michael, J., Partington, J.W., & Sundberg, C.A. (1996). The role of automatic reinforcement in early language acquisition. *The Analysis of Verbal Behavior, 13,* 21-37.

Authors Note

This experiment was conducted as part of the first author's PhD dissertation under the sponsorship of the second author. We are appreciative of the contributions of the children and the cooperation of their families during the conduct of this research.

Author contact information:

Hshin-Hui Tsai
e-mail: gabtsai@hotmail.com

Or

R. Douglas Greer
e-mail: dgreer3872@aol.com
Box 76 Teachers College
Columbia University
New York, NY 10027
