A COMPARISON OF THREE STRATEGIES FOR TEACHING OBJECT NAMES

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Researchers in applied behavior analysis have been charged to provide large-scale demonstrations of the outcomes of evaluations. In this research, three experiments were conducted to examine the relative efficacy of three methods of presenting stimuli in object naming tasks. Stimuli were introduced successively, simultaneously, or using a combination of the two procedures. College adults, mentally retarded children and adolescents, and preschool children were taught to produce the names of five Hebrew letters, English words, or American coins, respectively. Presentation method was a between-subjects treatment in a factorial design. Results from the series of systematic replications were consistent in showing better posttest performance for subjects in the Simultaneous and Combined conditions. Further, follow-up data in Experiment III showed that retention was also superior for subjects trained by the Simultaneous or Combined methods. Although the acquisition criterion was met in fewer trials by subjects in the Successive condition, only several minutes more training time was required by the Simultaneous and Combined conditions. From a cost-effectiveness point of view, either of the latter two techniques should be favored over the Successive procedure for teaching verbal naming skills.

DESCRIPTORS: stimulus presentation methods, simultaneous, successive, combined, verbal training

Evaluating teaching or training strategies is an important endeavor for applied behavior analysts. There are two considerations in using the information gleaned from such evaluations. First, much of the research within applied behavior analysis is based on training packages not fully evaluated or component analyzed. Thus, some of these packages may not be the most economical and efficient for producing the reported outcomes. Conducting methodological evaluations, therefore, provides important data to other researchers. Secondly, when the most efficient training procedures are known, they become more marketable to the potential consumers of the research (e.g., teachers of normal or developmentally disabled children, or individu-

als involved in training adults in vocational tasks). Results become more reliable when they have been replicated with differing subject populations and stimulus conditions. Recently, there has been a "charge" to researchers in applied behavior analysis to provide larger scale demonstrations than have been made in the past (Azrin, Note 1; O'Leary, 1977). In recognition of this mandate, the present study evaluated three teaching strategies with 96 subjects (college students, mentally retarded children and adolescents, and normal preschool children).

Teaching people the names of objects is a common educational and vocational training task. Preschool or mentally retarded children may be taught verbal labels for shape or color stimuli. Elementary school teachers often present words or arithmetic problems on flash cards to teach sight vocabulary and basic mathematics facts. Speech therapists may use a variety of stimuli to teach receptive and expressive language. In any number of occupations, new em-

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ployees are taught the names of such things as clothing items, vegetables, and equipment. Direct observation of personnel engaged in such instruction and examination of the research literature shows that several alternative procedures have been used to present the stimuli whose names are to be learned, but there is a dearth of comparative evaluations of these training procedures.

A method commonly employed, successive presentation, is characterized by teaching the names of stimuli one at a time (e.g., Lutzker & Sherman, 1974). A new stimulus is provided only after subjects emit a consistently high correct response rate to the target stimulus; items are presented and trained in serial fashion until the prescribed acquisition criterion has been attained for each.

For simultaneous presentation of stimuli, several objects are presented concurrently, and the verbal label of each is trained in the presence of the others. For example, Lahey and Drabman (1974) taught sight-word vocabulary to second-grade children using this strategy.

The successive and simultaneous presentation methods have their respective advantages and disadvantages for teaching verbal naming skills. In the successive method, there are massed, sequential trials on a single stimulus with no other objects to distract the subject. Presenting a single stimulus minimizes interference from other stimuli and responses and may enhance stimulus control. Because subjects are required to repeat the same response on consecutive trials, the acquisition criterion may be attained relatively rapidly. Also, massing training trials has been shown to benefit short-term retention (Bjork, 1970). Adversely, successive presentation impedes discrimination among stimuli. Because items are not presented concurrently, visual discriminative stimuli of previously trained items are not available to compare to the current training stimulus. During the training phase of the experiment, subjects emit the same response to the same stimulus over repeated and closely spaced trials. When a new response is being trained,

previous responses may undergo extinction, thereby producing poor results on a posttest which evaluates responses to all stimuli trained.

The advantages and disadvantages of simultaneous presentation are substantially the converse of those for the successive technique. Because several stimuli are presented concurrently, multiple discriminations are being trained, perhaps reducing the extinction effects likely under successive presentation training. Because multiple discriminations have been taught, posttraining retention should be superior using this method. In contrast, a disadvantage to simultaneous presentation is having to attend to multiple competing stimuli. Also, learning several novel responses concurrently may produce interference across items and increase the number of training trials required for acquisition.

Two previous studies are related to the present investigation. Schroeder and Baer (1972) taught verbal imitation to two mentally retarded girls by alternating serial (i.e., successive) and concurrent (i.e., simultaneous) training procedures. After achieving the acquisition criterion on training items, there were probes to untrained items of the same response class. There was no significant difference between the two conditions in the number of trials required to reach the acquisition criterion, but generalization was superior following concurrent training. More recently, Panyan and Hall (1978) found that serial (i.e., successive) and concurrent (i.e., simultaneous) task presentation methods were comparable with respect to acquisition by two severely retarded subjects; however, concurrent training resulted in more generalization. Retention scores were not consistently related to presentation method.

A combination of successive and simultaneous presentation methods could maximize the advantages and minimize the disadvantages of each. For example, stimuli could be presented successively in the initial phase of training. Subjects could attend rather easily to the relevant stimulus and respond correctly at a high rate. After several successive trials for each new stimulus,

it could be presented simultaneously along with those previously shown. This would permit direct visual discrimination among stimuli, thereby facilitating performance on subsequent test trials.

The principal purpose of the present study was to examine the relative efficacy of successive, simultaneous, and combined presentation methods. In order to increase the generality of the results, the experiment was replicated across three different subject populations using three different types of stimuli. Also, in contrast to the Schroeder and Baer (1972) and Panyan and Hall (1978) studies that employed two subjects each, the present study tested 96 persons.

EXPERIMENT 1

Method

Subjects. A sample of 30 undergraduate students, 9 males and 21 females, participated in Experiment 1. The students were solicited in a Behavior Modification course and were paid \$3.00 each for their participation.

Design. A one-factor completely randomized design was employed. The independent variable, Presentation Method, had three levels: Successive, Simultaneous, and Combined. Ten students were randomly assigned to each of the three levels.

Materials. The principal stimulus materials were five unlined white index cards, approximately 5×13 cm, each containing one of the following Hebrew letters: ז (zayin), ד (daled), ג (gimmel), א (aleph), and ל (lamed). The letters were drawn of equal size using a black felt tip pen and centered on the index cards. Additionally, the English spelling of each word was printed on a similar index card.

Procedure. Individual sessions were conducted, the duration of which was the time to: (a) reach the acquisition criterion on each of the five Hebrew letters and (b) complete the posttest. Sessions averaged approximately 20 min,

and only one was required for each participant. The third author was the experimenter.

Potential participants were asked whether or not they knew the names of Hebrew letters; those that said they did were screened out of the experiment. It was reasonable, therefore, to assume that participants' pretraining production competence was 0% for each of the five experimental stimuli.

The three training conditions had the following common elements:

1. The names of the stimuli were trained randomly.

2. On the initial presentation of a letter, the card with the English spelling was presented along with its Hebrew character. The experimenter produced the verbal label, students imitated once, and the English spelling was removed.

3. Subsequently, there was a series of training trials in which the experimenter pointed to one of the stimuli and said, "What is the name of this letter?" The acquisition criterion was a total of 15 correct responses. It was necessary to set the criterion at that high level because of the task requirements of the combined training condition.

4. Correct answers were reinforced by the experimenter saying, "Good." Incorrect responses were corrected, and the student was required to imitate the appropriate verbal name.

5. Immediately after attaining the acquisition criterion for all five letters, a posttest was administered. That test consisted of 10 random presentations of each of the five letters, without feedback or other consequences for responses. Items were presented successively.

Successive training. For the successive procedure, letters were presented for training one at a time. The first randomly selected Hebrew character was shown along with its English spelling, the experimenter modeled the name, the student imitated, and the English stimulus was removed. After students met the criterion of 15 correct responses, the next stimulus was presented for training. This procedure continued

until criterion had been met on all five Hebrew letters.

Simultaneous training. In the Simultaneous condition, all five Hebrew characters were placed in a horizontal row, spaced about 5 cm apart and approximately 15 cm in front of students. During the initial training trial, the experimenter pointed to each letter from students' left to right, produced the verbal label, and asked students to imitate. The English pronunciations, present during this process, were then removed. Training trials were administered randomly across the five stimuli until students made 15 correct production responses for each letter. The placement of the stimuli on the table was randomly rearranged after each block of five trials.

Combined training. This procedure incorporated elements of both successive and simultaneous presentation of stimuli. Each of the five Hebrew letters and its English pronunciation were introduced successively for one modeling and imitation trial. Subsequently, the stimuli were presented successively for a series of six correct training trials and then again simultaneously with all other letters previously taught. A letter, therefore, was re-presented for simultaneous training between one and four times depending on its random order in the sequence of instruction. The criterion for these simultaneous trials varied between two and five correct trials per letter each time it was re-presented for training.

The specific procedure of combining successive and simultaneous training trials is illustrated in Table 1. Training proceeded in the sequence shown by reading left to right across each row of the table. After meeting the criterion for the final set of training trials in a row, the instructional sequence shown in the next row was introduced immediately. For example, if "aleph" had been the first letter trained, it would have been presented individually until students responded correctly six times. The second Hebrew letter, "zayin," for example, then would have been presented alone for six correct trials. Next,

Table 1

Number of correct responses required for each stimulus in various phases of training in the combined condition.

Training Procedures	Stimulus Order Taught				
	1	2	3	4	5
Successive	6	6			
Simultaneous	3	3			
Successive			6		
Simultaneous	2	2	3		
Successive				6	
Simultaneous	2	2	3	5	
Successive					6
Simultaneous	2	2	3	4	9

"aleph" and "zayin" would have been presented simultaneously, and trained randomly until students responded correctly three times to each of the two letters. Skipping across Table 1 to the fifth stimulus, it too was presented alone for six correct training trials. Subsequently, all five Hebrew letters were shown and participants were required to respond correctly 2, 2, 3, 4, and 9 times to the first through fifth letters, respectively. The simultaneous component of the Combined condition was not identical to that used in the Simultaneous condition.

Dependent variables. There were two principal dependent measures: (a) total number of training trials to attain the acquisition criterion on the five stimuli and (b) proportion correct on the posttest for the five Hebrew letters. The initial trial in which students imitated the experimenter's model did not enter into the analysis.

Recording and reliability. Reliability of scoring the trials and posttest measures was checked by an independent observer for 10 randomly selected students of the 30 participants. Both the experimenter and reliability checker were fluent in Hebrew prior to the experiment and required only two practice participants to attain high interscorer agreement. The second observer was not an experimenter in any of the studies in this series; however, he was aware of the experimental condition in effect as well as the experimental questions involved. An agreement in scoring was defined as both persons recording

the same Hebrew letter and total trials to criterion. Reliability of the two dependent measures was calculated by percentage agreement between the two scorers by dividing the number of agreements by the number of agreements plus the number of disagreements and multiplying by 100. Reliability for training ranged between 92 and 100%, and for testing between 96 and 100%.

Results

The number of training trials to achieve the criterion of 15 correct responses for each of the five stimuli was computed: Simultaneous, $\bar{X} = 101.60$ ($SD = 14.94$); Successive, $\bar{X} = 75.40$ ($SD = .70$); and Combined, $\bar{X} = 81.80$ ($SD = 5.90$). The minimum total number of responses for the five Hebrew characters was 75. A one-factor analysis of variance showed a significant difference in performance across the three training methods, $F(2, 27) = 21.65$, $p < .001$. A post hoc Scheffé test ($p = < .05$) showed that students in the Simultaneous condition required significantly more trials to meet the acquisition criterion than participants in the other two conditions. Performance in the Successive and Combined conditions did not differ. Inspection of individual data showed that 8 of the students in the Simultaneous condition required the most training trials.

The mean proportions correct and standard deviations on the posttest for the three conditions were: Simultaneous, $\bar{X} = .94$, $SD = .10$; Successive, $\bar{X} = .50$, $SD = .38$; and Combined, $\bar{X} = .89$, $SD = .13$. An analysis of variance showed a significant difference among these conditions, $F(2, 27) = 10.10$, $p < .001$. The Scheffé ($p = .05$) showed that test performance in the Successive condition was significantly poorer than that in the other two conditions that did not differ from each other. Inspection of individual data showed that 7 of the 10 students in the Successive condition performed the poorest.

Discussion

The results showed that posttest performance on the Simultaneous and Combined conditions

was high and substantially superior to that in the Successive condition. Although more training trials were required in the Simultaneous condition, they took only several additional minutes to administer. Consequently, on a cost-effectiveness basis either the Simultaneous or the Combined techniques seem to be more effective.

EXPERIMENT 2

This study was a systematic replication of Experiment I using essentially the same procedures with mentally retarded students and English words as stimuli. The fifth author was the experimenter.

Method

Subjects. A sample of 36 moderately retarded institutional residents participated in Experiment 2. Pertinent developmental information is: mental age, $\bar{X} = 7$ yr, 6 mo ($SD = 2$ yr, 10 mo); IQ, $\bar{X} = 46.67$ ($SD = 16.20$); CA, $\bar{X} = 18$ yr, 4 mo ($SD = 2$ yr, 7 mo). Potential participants were shown the experimental words in one trial and those who knew any were screened out of the experiment.

Design. The design was the same as that for Experiment 1 except that 12 instead of 10 persons were randomly assigned to each condition.

Materials. The stimuli were five English nouns of six letters each: "advice," "cavity," "garage," "sailor," and "violin." Each was printed on an index card in a manner similar to the Hebrew letters in Experiment I. The stimuli were not associated to each other according to word association norms.

Procedure. Individual sessions, similar to those in Experiment I, averaged approximately 40 min, with only one required per participant.

The general procedures, as well as those for the three presentation methods, were the same in Experiment 2 as in Experiment 1 with the exception that the English words were used as stimuli instead of Hebrew letters.

Dependent variables. The same two dependent measures used for Hebrew letters were used for English words.

Recording and reliability. Reliability of scoring the two dependent measures was calculated for 10 randomly selected participants. The reliability checker was a graduate student who required only one practice session to achieve high agreement with the experimenter. She was not an experimenter in the other studies; however, she was aware of the condition in effect as well as the experimental question. The definition of agreement was analogous to that used in Experiment 1 and the reliability formula identical to that in the earlier study. Interobserver agreement was 100% for both dependent measures and for all participants.

Results

The mean number of training trials to attain the criterion of 15 correct per letter was as follows: Simultaneous, $\bar{X} = 109.25$ ($SD = 24.86$); Successive, $\bar{X} = 76.33$ ($SD = 2.19$); and Combined, $\bar{X} = 94.33$ ($SD = 24.44$). The analysis of variance showed a significant difference, $F(2, 33) = 8.01$, $p < .002$. Post hoc Scheffé comparisons ($p = .05$) indicated that there was a significant difference between performance in the Simultaneous and Successive conditions. The Combined condition did not differ from either of the other two. Individual data showed that 8 of the 10 children that attained 15 correct trials the fastest came from the Successive condition, and 7 of the 10 slowest learners came from the Simultaneous condition.

The mean proportions correct and standard deviations on the posttest for the three conditions were: Simultaneous, $\bar{X} = .73$, $SD = .23$; Successive, $\bar{X} = .41$, $SD = .33$; and Combined, $\bar{X} = .74$, $SD = .30$. There was a significant difference among the three conditions $F(2, 33) = 4.96$, $p < .01$, with performance in the Successive condition being significantly inferior to that in the other two levels (Scheffé, $p = .05$). Inspection of individual data showed that despite their rapid attainment of trials to criterion, 8 of the 10 lowest scores were contributed by children in the Successive condition.

Discussion

Retarded children took approximately as many trials to learn English words as college students did to acquire the names of Hebrew letters. Mean test performance was somewhat lower in the Simultaneous and Combined conditions for the retarded sample compared to their college counterparts; however, both the college students and retarded children scored approximately 50% correct on the Successive condition posttest.

More pertinent to the purpose of the present study, the comparative efficacy and interpretation of the results of the three conditions substantially replicate those of Experiment 1. Test performance in the Simultaneous and Combined conditions was superior, without substantial investment of training time over that for the Successive condition.

EXPERIMENT 3

This study was a systematic replication of Experiments 1 and 2 using essentially the same procedures with preschool children as subjects and coins as stimuli. In addition, a Test Trials factor was added. The second author was the experimenter.

Method

Subjects. A sample of 30 children from four different nursery schools participated in this experiment. The mean age of the 11 boys and 19 girls was 3.76 yr ($SD = .61$). The preschool served children primarily from middle-class families living in southern Illinois. The children were screened by asking them to state the names of the target coins in one trial and those who knew the names of three or more coins were excluded from participation.

Design. A two-factor mixed design with one repeated measure was used. The between-subjects factor, Presentation Method, incorporated the three levels used in the previous experiments. In addition, a within-subjects Test Trials

factor was introduced with three levels, Pre-, Post-, and Follow-up tests. The pretest was included to control for the level of pretraining acquisition among groups which was assumed to be greater than in Experiments 1 and 2. A follow-up, administered 4 weeks subsequent to the posttest, was given to each preschooler to measure maintenance of the effects.

Materials. The stimuli were five American coins: the penny, nickel, dime, quarter, and half-dollar.

Procedure. Individual training sessions, averaging approximately 30 min, were provided until children reached criterion on each coin name. Thus, the number of sessions varied across children. No more than one training session per day was held per child.

The general procedures, as well as those for the three specific presentation methods, were the same as for Experiments 1 and 2 with the substitution of coins as stimuli.

Dependent variables. The same trials to acquisition criterion and proportion correct on the test were the dependent measures once again. This time, however, the 50-item test was administered three times.

Recording and reliability. Reliability checks were made by an independent scorer on 12 randomly selected children for both dependent measures. The second scorer was a graduate student familiar with the experimental condition in effect as well as the research questions; however, she did not participate as an experimenter in this series. The definition of interobserver agreement was analogous to that previously used and the formula was identical. It took three practice sessions to achieve high interobserver agreement. Reliability ranged between 90 and 100% for both dependent measures.

Results

The mean number of training trials to attain the acquisition criterion for the three presentation conditions was as follows: Simultaneous, $\bar{X} = 117.40$ ($SD = 29.12$); Successive, $\bar{X} = 78.50$ ($SD = 3.34$); and Combined, $\bar{X} =$

111.00 ($SD = 27.16$). The analysis of variance indicated a significant difference among these three conditions $F(2, 27) = 8.17$, $p < .002$. A post hoc Tukey test ($p = .05$) indicated that children in the Successive condition acquired the responses in significantly fewer trials than participants in the other two conditions. The latter two conditions did not differ. Inspection of individual data showed that 7 of the 10 children in the Successive condition required the fewest trials.

Data on the proportion correct on the tests for the three Presentation conditions and three Test Trials are shown in Table 2. Equally low levels of pretraining competence for each of the three conditions are shown. An analysis of variance produced a significant Condition $\times$ Trials interaction, $F(4, 54) = 21.99$, as well as significant Condition, $F(2, 27) = 9.50$, and Trials, $F(2, 54) = 229.58$ main effects, $p < .001$ for each analysis. Tukey analysis of the interaction effect, $p = .05$, showed that the three pretest scores did not differ among themselves; however, all other means differed from each other.

In order to compare the outcomes across the three experiments, the mean performance on the trials to criterion and posttest dependent measures are shown in Figure 1. The histograms are plotted to permit direct comparison between the two dependent measures within each experimental condition. The figure highlights the rather consistent trends across stimulus materials and subject samples: (a) test performance in the Simultaneous and Combined conditions was superior to that in the Successive phase and (b) the 15 correct criterion per response was at-

Table 2

Proportions correct on the coin name production tests for preschool children in the three presentation conditions.

	Pretest		Posttest		Follow-up	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Successive	.16	.18	.42	.19	.19	.18
Simultaneous	.16	.20	.75	.13	.58	.18
Combined	.14	.17	.83	.14	.67	.21

Fig. 1. Mean trials to criterion and mean proportion correct on posttest for participants in the Simultaneous, Successive, and Combined conditions in each of the three experiments.

tained most rapidly in the Successive presentation condition.

Discussion

The data from Experiment 3, once again, showed poorest test performance for the Successive condition, only 42% correct. Posttest scores were highest for the Combined condition. In the absence of maintenance training, there was a substantial decrement in the 4-week follow-up tests, with participants in the Successive condition returning to their pretest levels, but reasonable retention by those in the Simultaneous and Combined groups.

Similar to Experiments 1 and 2, acquisition was statistically more rapid in the Successive condition, but in our opinion, the difference among conditions was not educationally meaningful (i.e., it was only several minutes faster). On a cost-effectiveness basis, the trade-off in additional time spent for instruction was well worth the higher posttest performance.

GENERAL DISCUSSION

The purpose of the present study was to compare successive, simultaneous, and a combined

procedure of presenting stimuli in a verbal naming task, and to test the generality of the findings across subject populations and types of stimuli. The data from the three experiments were remarkably consistent. The conclusion that seems reasonable is to use either the simultaneous or the combined procedures for training the names of objects. These techniques produced the highest posttest performance and did not require any more than a few extra minutes of training compared to the successive method. These findings hold for college adults, mentally retarded adolescents and children, and preschool children who learned to produce the names of Hebrew letters, English words, and American coins, respectively.

The effectiveness of the simultaneous procedure may be that it permits a subject to make a direct comparison among all the stimuli in the set which may facilitate discrimination. The spaced trials of the simultaneous task allow subjects to learn multiple discriminations.

The study applied a uniform and rather simple set of antecedent and consequence conditions and a common criterion to examine the immediate acquisition of verbal labels. In designing instructional programs, a more effective

set of antecedents and consequences possibly could be packaged. Also, while the data are clear that postacquisition training should be provided to help maintain the newly learned responses, retention was considerably better when subjects were trained using the simultaneous or combined procedures, rather than the successive training procedure. In any case, the superiority of the simultaneous and combined techniques over the successive one for immediate acquisition of verbal labels was demonstrated. This conclusion is strengthened even further when previous data showing the superiority of the concurrent (i.e., simultaneous) procedure for promoting generalization are considered (Panyan & Hall, 1978; Schroeder & Baer, 1972).

Although this study addressed a methodological question using many and different subjects, further research should focus on long-term follow-up, and in a variety of other tasks and settings, such as classrooms and vocational training centers. An important question to be pursued is whether the initial advantage of the simultaneous and combined procedures will hold up over a longer time period than an immediate retention test. Data from Experiment 3 suggested considerably better maintenance after 4 weeks for the simultaneous and combined conditions. However, from an applied point of view, one should program maintenance training as a companion to effective acquisition training techniques to increase the probability of retention. Also, no specific measures of trainer behavior (e.g., praise, feedback) were taken in this study. These, too, could be examined in future

research. Nevertheless, the data from this study should be useful in several areas, such as generative language and the training of preacademic and academic skills.

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