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Attention to Multiple Cues by Severely Mentally Retarded Adults: Effects of Single-Component Pretraining

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The present investigation examined whether the amount of compatible single-element training affected response accuracy for conditional-discrimination tasks requiring attention to multiple cues. Four severely mentally retarded adults participated, and a multiple baseline across subjects and reversal design was employed. Following acquisition of conditional discriminations by individually training each stimulus element, transfer tests were provided. In the first transfer condition, two intermixed conditional-discrimination tasks were presented containing identical stimuli to those individually trained. The second transfer condition consisted of two intermixed conditional-discrimination tasks composed of novel S− stimuli and pretrained S+ stimuli. Finally, a control procedure was administered in which conditional-discrimination tasks contained all untrained cues. The severely mentally retarded subjects did learn to respond to multiple cues. Establishing separate control by each component produced attention to two aspects of compound stimuli with few errors occurring. In addition, these broadened attentional skills generalized to multistimulus tasks containing all or some of the original pretrained stimuli. If single-element training was omitted, performance on conditional-discrimination tasks was greatly impaired.

Attentional deficits are prevalent among the mentally retarded and prevent mentally retarded individuals from learning many skills as quickly as nonmentally retarded individuals (Zeaman & House, 1963). One common problem is overselective attention. Investigators report that when they present compound training cues to developmentally disabled children, they attend to a more limited portion of the compound than intellectually average children (Koegel & Wilhelm, 1973; Lovaas & Schreibman, 1971; Lovaas, Schreibman, Koegel, & Rehm, 1971; Schreibman & Lovaas, 1973; Ullman, 1974; Wilhelm

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& Lovaas, 1976). Stimulus overselectivity is especially pronounced among autistic and severely mentally retarded individuals (Wilhelm & Lovaas, 1976), which hinders their language acquisition and social development (Dunlap, Koegel & Burke, 1981). It also explains why added-prompt fading procedures often fail as instructional techniques with this population (Koegel & Rincover, 1976; Schreibman, 1975; Wolfe & Cuvo, 1978). Rincover and Koegel's (1975) findings further suggest that developmentally-disabled individuals frequently fail to transfer skills across settings due to only restricted aspects of the treatment setting gaining stimulus control.

Stimulus overselectivity is not an unmodifiable perceptual characteristic. Recently developed teaching techniques have successfully eliminated selective attention in both autistic (Koegel & Schreibman, 1977; Koegel, Schreibman, Britten, & Laitinen, 1979; Schover & Newson, 1976; Schreibman, Koegel, & Craig, 1977) and severely mentally retarded students (Huguenin & Touchette, 1980; Meisel, 1981). A critical factor for determining how mentally retarded individuals respond to compound training cues is the prior reinforcement history of the separate components. Huguenin and Touchette (1980) discovered that training compatible stimulus control for each stimulus component before the compound was formed prevented selective attention in severely mentally retarded clients. The specific procedure consisted of first conditioning color and then line orientation to exhibit stimulus control. After criterion accuracy was achieved for each discrimination, the stimuli were combined. Tests revealed selective attention was not demonstrated when the prior reinforcement histories of both stimulus elements were maintained in the compound. If one of the elements composing the compound had a conflicting prior history of reinforcement, however, that aspect of the compound was usually ignored. Tomiser, Hollis, and Monaco (1983) later replicated these findings using cues from the haptic modality.

The current study determined if the amount of compatible single-element training affected response accuracy for conditional-discrimination tasks demanding attention to multiple cues. Trial and error and added-prompt fading procedures are frequently ineffective procedures for teaching conditional discriminations to children (Gollin & Savoy, 1968; Schilmoeller, Schilmoeller, Etzel, & LeBlanc, 1979). Autistic and mentally retarded students have a particularly difficult time acquiring conditional discriminations, and stimulus overselectivity is often responsible for their high percentage of errors. Koegel and Schreibman (1977) demonstrated this when they compared the performance of autistic and intellectually average children on a task where responding was only reinforced if an auditory and visual cue appeared together. If the children responded when either cue was presented alone, extinction resulted. The intellectually average children learned the conditional discrimination in fewer trials, because the autistic children persisted in responding to one of the individual cues, which prevented acquisition for hundreds of trials. One purpose of my investigation was to discover whether severely mentally retarded clients could learn a similar conditional discrimination with few errors occurring if separate control by each stimulus component was first established. Perhaps if stimulus overselectivity was prevented by training each component to exercise compatible stimulus control, this might facilitate acquisition of conditional discriminations requiring attention to multiple cues. In addition, the performance on three transfer conditional-discrimination tasks was examined, in which the amount of prior single-element training provided to the mentally retarded adults varied. It was predicted that conditional-discrimination tasks composed of identical stimuli to those individually trained would produce higher response accuracy than conditional-discrimination tasks containing some or all novel cues.

METHOD

Subjects and Setting

Four severely mentally retarded adults with no sensory impairments served as subjects. Each subject was classified by the professional staff at the facility where they resided. Their mental ages varied from 3 to 5 years, and all four subjects could follow simple commands. Significant changes in their regular medication did not occur during the study.

The study was conducted in an empty room at the residential facility. Each subject sat in a chair facing a table that contained stimulus materials, and the experimenter sat beside the subject. A plastic cup for placing reinforcers acquired during the session was located to the left of each subject.

Stimulus Materials

All stimulus materials were presented on white display sheets, enclosed in clear plastic, and inserted in a three-ring notebook. The two stimulus cards for a specific trial appeared on a single page, 5 cm apart. During the first two phases of the experiment, the S+ and S− stimuli were composed of white animal pictures, approximately 3 cm by 4 cm in size, which were centered on 7.6 square cm cards of varying colors. In the third phase, symbols (Dreyfuss, 1972) were utilized, and they were centered on 7.6 square cm white cards.

Experimental Design

With the exception of Subject 4, a multiple baseline across subjects (Hersen & Barlow, 1976) and reversal design were employed to determine if the number of pretrained stimuli influenced response accuracy during transfer conditional-discrimination tasks. In the first transfer test, two intermixed conditional-discrimination tasks were presented where each separate stimulus had been previously trained (total pretraining). The second transfer test (partial pretraining) consisted of two intermixed conditional-discrimination tasks with novel S− stimuli and pretrained S+ stimuli. As a control procedure, subjects were also presented with two intermixed conditional-discrimination tasks where none of the individual stimulus elements had been previously conditioned.

General Procedure

Teaching sessions varied between 60 to 80 trials in length. A trial began when the subject was first presented with a pair of stimulus cards and the verbal request, "Show me the correct card." The trial ended when the subject touched one or both cards. A 3-second intertrial interval followed, and then the next trial began. Correct choices produced praise and tangible reinforcement (either edibles or tokens). Following an incorrect choice or touching both cards simultaneously, the experimenter said "No," did not provide any reinforcement, and increased the intertrial interval to 8 seconds. Incorrect choices also resulted in a correction procedure during training sessions whereby the experimenter would point to the correct card and request the subject to touch it. When the subject complied, praise was provided but not tangible reinforcement. The opportunity to exchange accumulated tokens for primary reinforcement occurred at the end of each session. Stimuli were presented in an unpredictable sequence, with the restriction that S+ cards were never presented more than twice in succession in the same location.

Phase One

Single-component and conditional-discrimination training. In Phase One, four separate visual discriminations were established for Subjects 1, 2, and 3. The S+ and S− stimuli were presented simultaneously, and they were composed of animal pictures on colored backgrounds. Stimulus control by the animal component of the first training compound, lion on red background, was achieved by making the red element common to both the S+ and S− cards and consistently pairing lion with reinforcement. Dog was always paired with extinction. Following 95% accuracy in a 60-trial session, control by the color component of the red-lion compound was obtained. Now, lion appeared on both the S+ and S− cards, and only the red and white stimuli were consistently paired with reinforcement and extinction, respectively. When 95% accuracy was achieved for color, both S− cards (red-dog and white-lion) were successively presented in a random sequence with the red-lion S+ compound, with the restriction that the same S− condition could not appear more than 3 times in succession. This procedure insured sustained attention to both aspects of the red-lion compound when criterion accuracy (one error or less in both S – conditions during a 20-trial sequence) was demonstrated, as selective responding to only one of these components would have prevented continuous reinforcement. After the initial acquisition criterion was met for the red-lion conditional discrimination, additional trials were administered until criterion performance persisted throughout a 60-trial sequence.

The same procedures were applied to the second training compound (seal on green background). Stimulus control by its animal component was obtained by making green common to both the S+ and S – cards and consistently pairing seal and lamb with reinforcement and extinction, respectively. After criterion accuracy occurred, control by the color component of the green-seal compound was established. Seal appeared now on both the S+ and S – cards, and green and white backgrounds were consistently paired with reinforcement and extinction, respectively. After 95% accuracy was achieved, both S – cards (green-lamb and white-seal) were successively presented in a random sequence with the green-seal S+ compound until criterion accuracy was met and continued for 60 trials.

Phase Two

Total-pretraining transfer test. In Phase Two, three test conditions were administered to determine the effect of the pretrained discriminations in Phase One on transfer conditional-discrimination tasks. In the first transfer test condition (total pretraining), two intermixed conditional-discrimination tasks that contained identical stimuli to those individually trained were presented to Subjects 1, 2, and 3. Each conditional discrimination involved in this transfer condition had been previously trained in Phase One, but the two conditional discriminations had never before been presented together (see Figure 1). The sequence employed in a 40-trial test session consisted of 10 trials of conditional discrimination 1, 10 trials of conditional discrimination 2, 10 trials of conditional discrimination 1, and 10 trials of conditional discrimination 2. Subject 1 received one test session, Subject 2 received two test sessions, and Subject 3 was given four test sessions in the total-pretraining transfer condition.

Partial-pretraining transfer test. A second transfer test was next administered to Subjects 1, 2, and 3. It consisted of two intermixed conditional-discrimination tasks, of which only the S+ cues were previously trained in Phase One. The S – cues (snail, owl, and yellow) were not conditioned prior to the test (see Figure 1). This test assessed if each subject would attend to both elements of two intermixed stimulus compounds when only partial pretraining was given. Subjects 1 and 2 each received one test session, and Subject 3 received two test sessions in the partial-pretraining transfer condition.

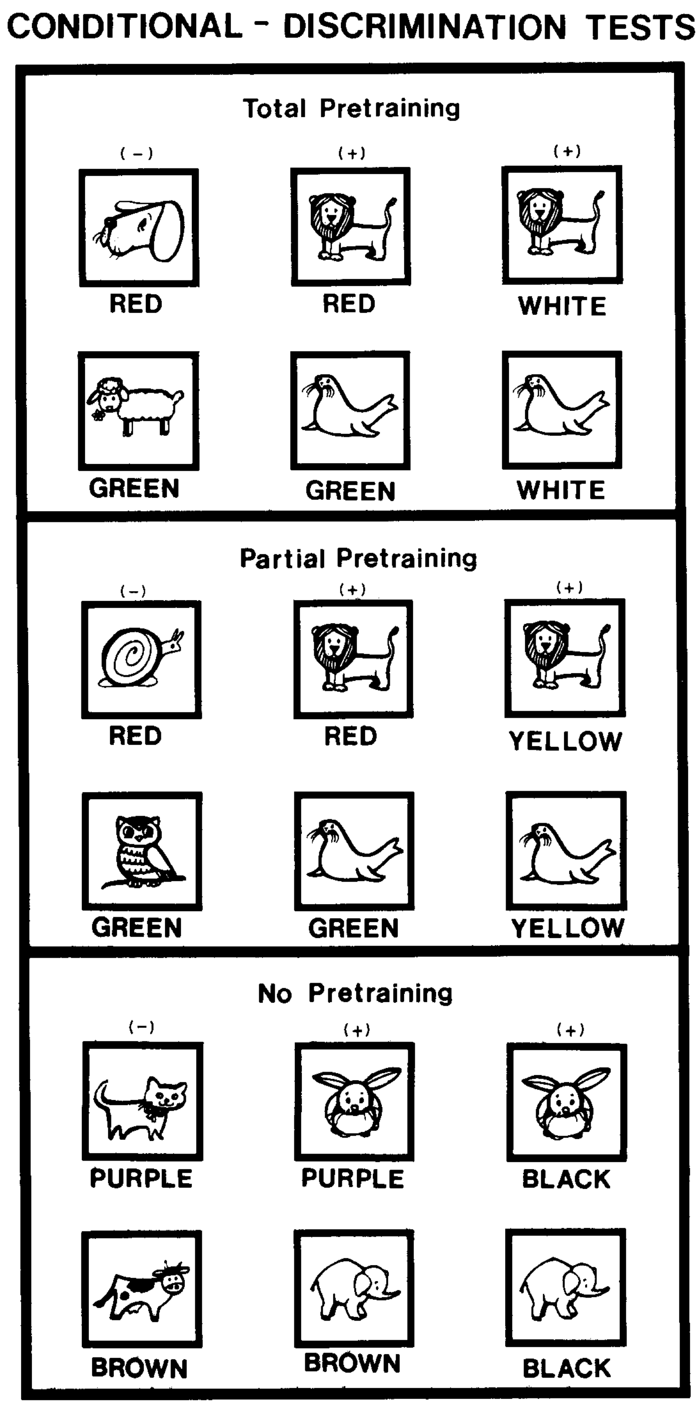


FIGURE 1. Diagram of the three test conditions involving two intermixed conditional-discrimination tasks. Cards consistently paired with reinforcement are indicated by a plus (+). Cards consistently paired with extinction are indicated by a minus (−).

No-pretraining conditional-discrimination test. As a control procedure to determine if any generalization occurred in either the total or partial pretraining transfer conditions, two intermixed conditional-discrimination tasks containing all novel cues were presented to Subjects 1 and 3 and a naive subject (4). Rabbit and elephant on purple and brown backgrounds, respectively, were the S+ compounds. None of the color or animal components had been separately trained prior to the 40-trial test session that was administered to those subjects (Figure 1). In addition, the naive subject (4) was given intermixed conditional-discrimination tasks composed of the same S+ and S− stimuli employed in the previous two transfer tests, but stimulus pretraining was omitted. Both conditional-discrimination tests were delivered to subject 4 for one 40-trial session. This test condition examined the attentional patterns each subject displayed when two intermixed compounds containing only untrained cues were presented. Table 1 indicates the sequence of procedures and stimuli in Phases One and Two.

Phase Three

Manipulating pretraining for additional conditional-discrimination tasks. In Phase Three, either no stimulus pretraining or total-stimulus pretraining was given to Subject 2 for two additional conditional-discrimination tasks. Both tasks utilized cues from stimulus classes other than those in the preceding

TABLE 1.
Number of Trials Administered to Each Subject and the Sequence of Stimuli in the Different Procedures of Phases One and Two

	Phase One				
	Subjects 1	2	3	4	Stimulus Materials[a]
Component training	180	120	550	–	S+1, S−1; S+1, S−2
Condit. discrim. training	60	60	360	–	S+1, S−1, S−2
Component training	250	120	375	–	S+2, S−5; S+2, S−6
Condit. discrim. training	245	60	190	–	S+2, S−5, S−6
	Phase Two				
	Subjects 1	2	3	4	Stimulus Materials[a]
Total pretraining test	40	80	160	–	S+1, S−1, S−2; S+2, S−5, S−6
Partial pretraining test	40	40	80	–	S+1, S−3, S−4; S+2, S−7, S−8
Total pretraining test	–	40	40	–	S+1, S−3, S−4; S+2, S−7, S−8
No pretraining test	40	–	40	40	S+3, S−9, S−10; S+4, S−11, S−12

[a]Key: S+1 red lion, S+2 green seal, S+3 purple rabbit, S+4 brown elephant; S−1 red dog, S−2 white lion, S−3 red snail, S−4 yellow lion; S−5 green lamb, S−6 white seal, S−7 green owl, S−8 yellow seal; S−9 purple cat, S−10 black rabbit, S−11 brown cow, S−12 black elephant.

phases. The first conditional discrimination required selecting a card containing both boat and lighthouse symbols for continuous reinforcement. If cards displaying either boat and trailer or lighthouse and bike were selected, extinction resulted. In a second conditional-discrimination task provided to Subject 2, a 2 cm blank square was consistently paired with reinforcement. The S – cues were a smaller blank square and a line-dissected square of equal size. The two S – conditions for each task were successively presented in a random sequence with the S + compound. Both conditional-discrimination tasks were administered for 20 trials before and after the subject was trained to respond to each component of the S + compounds. Single-stimulus pretraining was accomplished for both tasks by presenting only one S – condition at a time with the S + compound until criterion accuracy was reached for each discrimination. Table 2 indicates the sequence of procedures and stimuli in Phase Three.

Reliability

Two independent observers scored subject performance and noted each trial if a correct response occurred. One of the observers was the author of this study. The second observer was a staff member at the residential facility. Reliability was assessed in different steps of the procedure. The percentage of interobserver agreement was calculated by dividing the number of observer agreements by the number of agreements plus disagreements and multiplying by 100. The percentage of interobserver agreement was 100% throughout.

RESULTS

Single-Component Training

Subjects 1, 2, and 3 did not acquire the four single-component discriminations at the same rate. Although they learned to exclusively respond to the color components of both S + compounds in one session, more variable be-

TABLE 2.
Number of Trials Administered to Each Subject and the Sequence of Stimuli in the Different Procedures of Phase Three

	Phase Three				
	Subjects				Stimulus
	1	2	3	4	Materials[a]
No pretraining test	–	20	–	–	S + 5, S – 13, S – 14
Component training	–	180	–	–	S + 5, S – 13; S + 5, S – 14
Total pretraining test	–	20	–	–	S + 5, S – 13, S – 14
No pretraining test	–	20	–	–	S + 6, S – 15, S – 16
Component training	–	120	–	–	S + 6, S – 15; S + 6, S – 16
Total pretraining test	–	20	–	–	S + 6, S – 15, S – 16

[a]Key: S + 5 boat lighthouse, S + 6 blank square (2 cm); S – 13 boat trailer, S – 14 bike lighthouse; S – 15 line-dissected square (2 cm), S – 16 blank square (1.3 cm).

havior occurred when selective attention to the animal components was demanded. One to eight sessions for lion and one to five sessions for seal were needed before the subjects achieved these discriminations. Subjects 1 and 3 displayed an initial color preference because they each required more sessions to reach criterion performance for the animal components of the S+ compounds as compared to the color cues.

Conditional-Discrimination Acquisition

When the two S− conditions appeared together successively with each S+ compound, a conditional-discrimination task requiring attention to multiple cues resulted. Subjects 1, 2, and 3 achieved the initial acquisition criterion (one error or less in both S− conditions during a 20-trial sequence) for the conditional-discrimination tasks with few errors occurring. Each subject acquired the red-lion conditional discrimination, emitting only one error. Four was the maximum number of errors before the green-seal conditional discrimination was learned. Sustained control by both the animal and color components of the two S+ compounds quickly developed, therefore, after single-stimulus training was provided.

Total-Pretraining Transfer Test Performance

Figure 2 illustrates the transfer performance of Subjects 1, 2, and 3 when total-stimulus training preceded the conditional-discrimination test. If two intermixed conditional-discrimination tasks contained identical stimuli to those separately trained (total pretraining), the three subjects achieved accuracy scores of 80% or greater for each component of both S+ compounds. Thus, the subjects persisted in attending to the animal and color elements when the red-lion and green-seal compounds were intermixed for the first time during the transfer test. In addition, the amount of exposure to the total-pretraining transfer condition failed to affect the percentage of responses to the S+ components. Subjects 1, 2, and 3 were administered one, two, or four test sessions, respectively, and they obtained high accuracy scores throughout.

Partial-Pretraining Transfer Test Performance

If only the S+ cues of two intermixed conditional-discrimination tasks were previously trained, whereas the S− cues were untrained (partial pretraining), transfer performance was impaired. Limited transfer occurred for Subjects 1, 2, and 3, as only one of the original stimulus compounds continued to support attention to each of its components (see Figure 2). Green-seal was the single compound for Subjects 1 and 2 where the animal and color elements displayed high levels of stimulus control. Subject 3, in contrast, was controlled by both elements of only the red-lion compound.

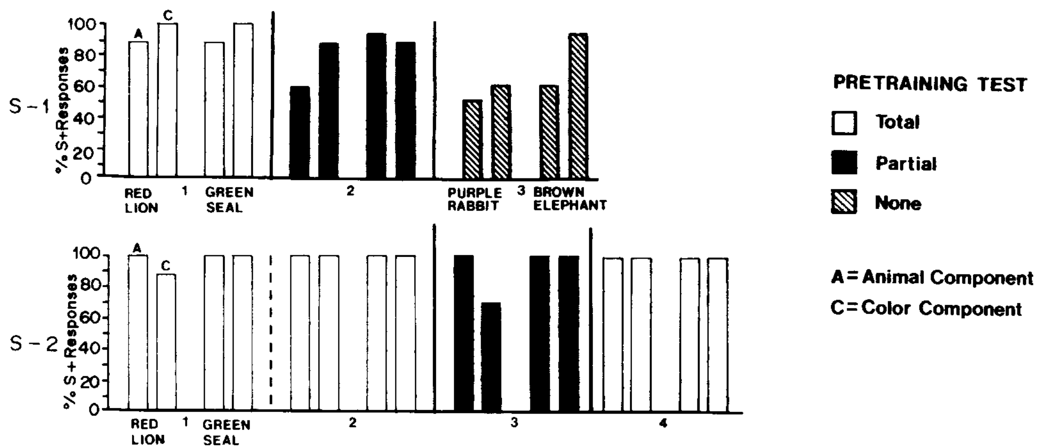


FIGURE 2. Percentage of responses to the animal (A) and color (C) components of two intermixed S+ compounds during 40-trial conditional-discrimination test sessions following total pretraining (white bars), partial pretraining (black bars), or no pretraining (slashed bars). Response percentages for each component of the S+ compounds were determined from trials where that component predicted reinforcement and the remaining component appeared on both the S+ and S− cards. Test results for each subject appear in the order in which the different testing conditions were administered.

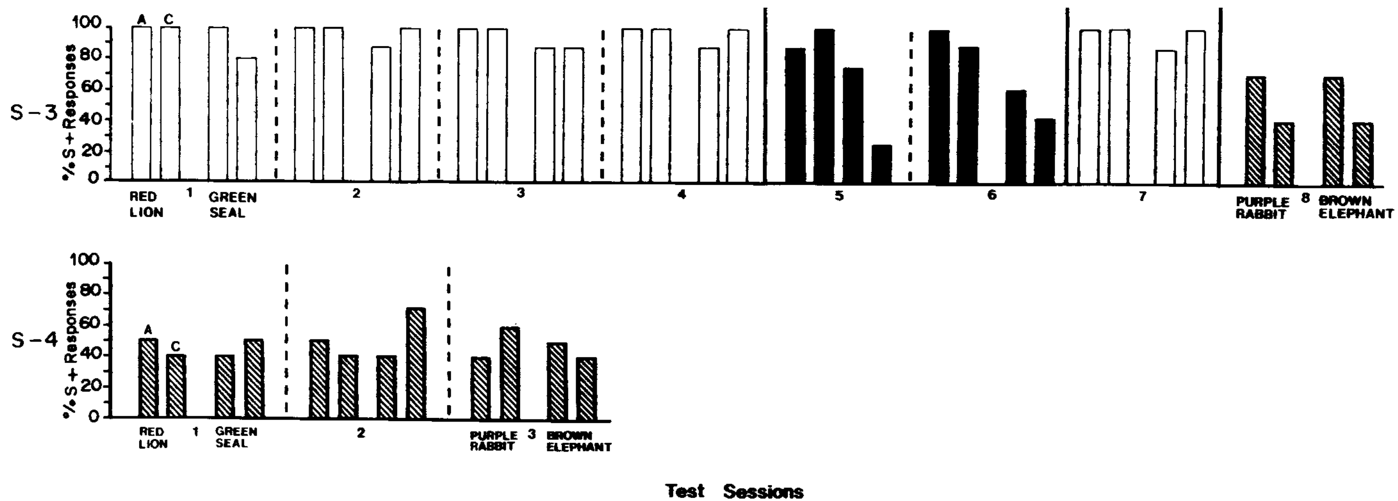


FIGURE 2. continued

Concerning the remaining partially pretrained compounds, stimulus control by at least one of the S+ components was disrupted in the transfer test. Subject 1, for example, selectively attended to the color element of the red-lion compound when novel S− stimuli were introduced. The red-lion compound also produced selective attention for Subject 2, but in this instance only the animal component exerted a high level of control. Neither the animal nor color elements of the green-seal compound were associated with high accuracy scores for Subject 3 in the partial pretraining condition. The percentage of this subject's responses to each S+ element also did not increase when extra test trials were given (Figure 2).

Reimplementation of Total Pretraining

Total pretraining was reinstated for Subjects 2 and 3 following conditional-discrimination transfer tasks where only the S+ stimuli had been previously conditioned (partial pretraining). Both subjects exhibited loss of stimulus control during test trials containing novel S− cues. When pretraining was again individually provided for all the S+ and S− stimuli composing both conditional-discrimination tasks, accuracy scores increased to levels originally observed (Figure 2).

No-Pretraining Conditional-Discrimination Test Performance

For the two intermixed conditional-discrimination tasks employing all untrained cues, neither stimulus compound produced attention to both components (Figure 2). In the majority of cases, stimulus control was not observed for either the color or animal components of the novel compounds. In one exception, selective attention occurred, as Subject 1 did selectively respond to the color component of the brown-elephant compound. Whether or not stimulus pretraining was provided controlled the occurrence of attention to multiple cues. The test results of the naive subject (4) that indicate impaired performance for compounds composed of untrained elements were not due to the particular stimuli utilized. When Subject 4 was given the same conditional-discrimination tasks presented in the previous tests but with all pretraining omitted, low response accuracy for each component was displayed.

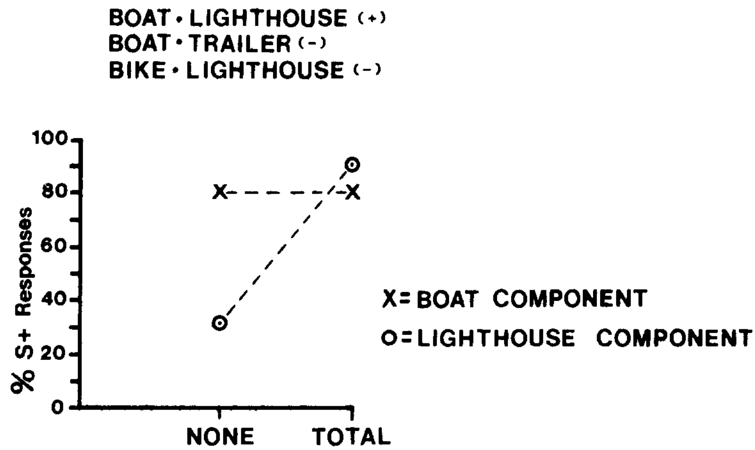
Effect of Pretraining on Additional Conditional-Discrimination Tasks

When Subject 2 was given two extra conditional-discrimination tasks employing cues from differing stimulus dimensions, stimulus pretraining continued to produce attention to multiple components. If the training compounds contained only novel cues (no pretraining), selective attention and lack of control by each component occurred (Figure 3). After stimulus control was separately trained for each component, however, Subject 2 displayed high response accuracy throughout the conditional-discrimination tests.

DISCUSSION

The results of this investigation indicate that severely mentally retarded adults can learn to respond to multiple cues. Establishing separate control by individual components produced nearly errorless acquisition of conditional-discrimination tasks requiring attention to multiple aspects of complex training cues. This instructional procedure proved successful, because it prevented stimulus overselectivity from occurring when the multistimulus tasks were presented. These results confirm earlier findings (Huguenin & Touchette, 1980). Compatible single-element training not only controls the number of elements of compound discriminations that mentally retarded clients attend to, but it also affects their conditional-discrimination performance as shown here. An advantage of using the conditional-discrimination paradigm of this study to evaluate effects of prior stimulus training is that it directly tests whether or not attention to multiple elements occurs. Selective attention is immediately revealed, because responding to only one component typically creates chance performance on trials when that stimulus appears in both the S+ and S− compounds. In contrast, tests provided by presenting individual components alone after the acquisition of compound discriminations can only infer attentional patterns produced by compound training cues. Such procedures are subject to contamination by test variables and might not accurately reflect, therefore, what aspects of the compound actually did control responding. Indeed, past studies have found conflicting results when different tests were used following criterion performance for the same compound discrimination (Huguenin & Touchette, 1980; Newman & Benefield, 1968; Wilkie & Masson, 1976).

Following single-component pretraining, the severely mentally retarded clients acquired conditional discriminations with few errors. When Koegel and Schreibman (1977) presented a similar conditional-discrimination task to autistic children, they exhibited a large number of errors after each component was separately trained. These discrepant results may be attributed to the type of pretraining provided. In Koegel and Schreibman's study, stimulus components presented alone originally indicated reinforcement availability, but later became the S− stimuli during the conditional-discrimination task. By manipulating whether the color or animal component of the S+ compound appeared in the S− condition, the severely mentally retarded clients in this study learned to selectively attend to each feature while the S+ compound was present throughout. Stimuli paired with nonreinforcement in pretraining were also S− stimuli during the conditional-discrimination task.



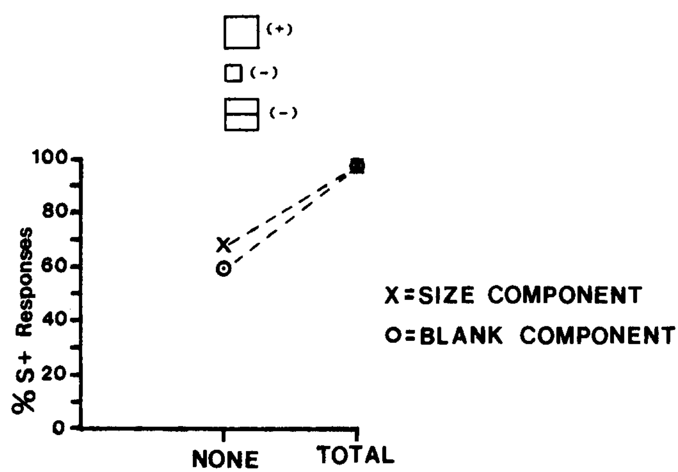


FIGURE 3. Percentage of responses to both components of additional S+ compounds during 20-trial conditional-discrimination tests when either no stimulus pretraining or total-stimulus pretraining was given to Subject 2. Response percentages for each component of the S+ compounds were determined from trials where that component predicted reinforcement and the remaining component appeared on both the S+ and S− cards.

Employing identical S+ and S− stimuli during single-component and conditional-discrimination training probably increased generalization of original training effects and, hence, produced errorless acquisition of the conditional discriminations.

In addition, the extent of compatible single-component training influenced response accuracy for transfer tasks involving two intermixed conditional discriminations. If all of the individual components were separately trained, mentally retarded clients attended to both features of the intermixed S+ compounds. Performance was impaired if only partial pretraining was provided. Establishing compatible control for each S+ component did not produce attention to all stimulus aspects of both compounds if novel S− cues appeared. For half of these tasks, either stimulus overselectivity or lack of control by each component was observed. Single-element training was critical for the occurrence of attention to multiple cues. When mentally retarded clients were given two intermixed conditional-discrimination tasks where none of the stimuli were previously trained, neither S+ compound demonstrated control by its separate components.

The degree of similarity between training and transfer conditional-discrimination tasks determined the extent to which broadened attentional skills of severely mentally retarded adults generalized to untrained conditions. Attention to multiple stimulus components occurred in transfer situations by maintaining all or some of the original pretrained stimuli. The greater the number of stimuli in common between training and extra-training conditions, the less original treatment effects were disrupted. Lack of generalization of treatment gains is commonly exhibited by developmentally disabled individuals (e.g., Handleman, 1979; Koegel & Rincover, 1974; Murdock, Garcia, & Hardman, 1977). Bringing target behaviors of these students under the control of specific training cues and then introducing identical stimuli in untrained settings is a potent generalization-enhancing technique (Stokes & Baer, 1977). It has resulted in the successful transfer of self-help skills (Nutter & Reid, 1978; Page, Iwata, & Neef, 1976), language skills (Duker & Michielsen, 1983; Halle, Marshall, & Spradlin, 1979; Koegel & Rincover, 1974; Rincover & Koegel, 1975; Welch & Pear, 1980), and social behaviors (Huguenin & Mulick, 1981) to extra-training situations. The results of this investigation indicate that programming common stimuli can also facilitate the transfer of attentional skills for mentally retarded clients. In addition, the number of common elements influences the extent to which their broadened attentional skills continue to occur when original training procedures are altered. Future studies should systematically investigate the effect of this variable for other educational skills to determine its versatility in increasing transfer gains.

In summary, severely mentally retarded adults quickly acquired conditional discriminations that required attention to multiple cues if control by each stimulus component was first trained in isolation. Maintaining compatible reinforcement contingencies of separate stimuli in compound displays was an efficient technique for broadening the attentional skills of mentally retarded clients. This finding has important educational implications, because a prerequisite skill for learning to occur in classroom settings is the ability to respond to multiple cues. Following instructions, language acquisition, and observational learning are just a few illustrations of behaviors that cannot be acquired if this capacity is lacking. Breaking down complex training cues and pretraining their constituent components succeeded in teaching conditional discriminations errorlessly, as it ensured the students attended to the relevant dimensions of the task. Zeaman and House (1963) maintain that mentally retarded students fail to learn essential skills because they attend to fewer and possibly different aspects of their environment than nonmentally retarded students. Similar procedures to the one described in this paper may permit mentally retarded students to acquire critical attentional behaviors for learning educational tasks employing complex cues.

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