INSTRUCTION-FOLLOWING BEHAVIOR OF A RETARDED CHILD AND ITS CONTROLLING STIMULI¹

SEBASTIAN STRIEFEL AND BRUCE WETHERBY

BUREAU OF CHILD RESEARCH, UNIVERSITY OF KANSAS,
AND PARSONS STATE HOSPITAL TRAINING CENTER, PARSONS, KANSAS

A combination of positive reinforcement and fading of physical guidance was used to teach a profoundly retarded boy specific responses to specific verbal instructions. The design consisted of a multiple baseline of probe data across different verbal instructions. The subject started responding correctly to each verbal instruction as that item was trained in a multiple-baseline order. Generalization did not occur to items that had not yet been trained, nor did it occur to items included to assess generalization. Probes of variations in the verbal instructions, conducted after training was completed, revealed that generalization was minimal except in those cases where the variation consisted of the verb only, the noun only, the noun plus preposition, or where the verb of the instruction was presented last. Training a profoundly retarded 11-yr-old subject to respond to specific verbal instructions did not adequately facilitate the development of a generative instruction-following capability, nor did all verbal elements of the instruction control a specific response.

Instruction-following behavior can be defined as the ability to make the appropriate response to a verbal command. Whitman, Zakaras, and Chardos (1971) used a combination of reinforcement and physical guidance to increase the instruction-following behavior of two severely retarded children. Increases in such behaviors occurred for both trained and untrained items. In the discussion, they mentioned that it was unclear whether the increases seen in instruction-following behavior were due to a lack of motivation on the part of the subjects before training, to the subjects' learning specific responses, or to having responses come under the control of specific stimuli. In addition, if the subject continually failed to respond to an in-

struction, the experimenter trained the next instruction. The purpose of the present study was to train a profoundly retarded boy to follow instructions, assess generalization, and determine whether all elements of the verbal instruction control a specific response.

METHOD

Subject

An 11-yr-old male profoundly retarded resident of an institution for retarded children served. He had previously been trained to remain seated, keep his hands in his lap, make eye contact with a person calling his name, and to imitate (Striefel, Eberl, and Gast, 1972). He exhibited no vocal behavior other than a kind of crying sound at the onset of this study.

Setting and Reliability

The experimental space consisted of two rooms connected by one-way mirrors and an intercom system. The subject was seated face-to-face with the adult male experimenter alongside a table. Sessions were conducted once or twice a day, Monday through Friday. A second observer periodically recorded the subject's responses for the collection of reliability data.

¹Appreciation is expressed to David Gast for the time he spent conducting training sessions, to Janet Striefel for preparation of the figures in this manuscript, and to Dr. Joseph Spradlin, Dr. Robert Fulton, and the editors of the *Journal of Applied Behavior Analysis* for their critical comments concerning the manuscript. This research was supported by grant HD 00870 from the Department of Health, Education, and Welfare, Public Health Service, National Institutes of Child Health and Human Development. Reprints may be obtained from Sebastian Striefel, Parsons Research Center, Parsons State Hospital, Parsons, Kansas 67357.

General Training and Experimental Design

The verbal instructions used were divided into two groups: (1) items to be trained (training items), and (2) items never to be trained but included to assess generalization (generalization items). Table 2 lists both the training and generalization items. Control and evaluation of the training procedures were accomplished by a multiple baseline, across-behaviors design. The multiple baseline incorporated probe data collected both before and during training sessions for each training and each generalization item.

Initial Baselines

Six sessions of baseline data were collected. A trial consisted of the experimenter placing four objects on the table and saying the subject's name; when the subject made eye contact, a verbal instruction was given. The subject was then allowed about 5 sec to respond. No consequences followed correct responses during the first three sessions of baseline, but each correct response was followed immediately by verbal praise and ice cream during the last three sessions of baseline. Behaviors performed correctly on all days of the initial baseline were considered learned and were not trained. The other training items were randomly arranged into the order shown in Table 2 (hereafter called the subject's List of Behaviors to be Trained) and were trained in that order.

Probe Data

A probe sequence occurred immediately before the training of each behavior, and consisted of three trials on each of the three behaviors at the top of a subject's List of Behaviors to be Trained. The nine randomly presented trials of a probe sequence served as last-minute baseline data. A second kind of probe data was collected to help assess whether generalization occurred as a function of training. Daily, starting with Session 84, the experimenter probed three behaviors that were yet to be trained and

two generalization items. These probes resulted in a total of 20 or 21 additional probes on each item. Responses to these daily probes were never reinforced, and the behaviors probed rotated so that all behaviors were probed every few sessions.

Instruction-Following Program

The Instruction-Following Program consisted of probe sequences (previously described), training trials, putting-through procedures, and random sequences. A training trial consisted of the trainer saying the subject's name; when eye contact occurred, the trainer would give a verbal instruction, allow the subject about 5 sec to respond, and deliver contingent verbal praise and ice cream if a correct response occurred.

Each of the training items were broken down into a series of steps for hand-shaping purposes. The putting-through procedure consisted of the steps each behavior had been broken into. The trainer systematically faded out his physical guidance until all that the trainer did was to give the verbal instruction, and the subject would complete the response on his own. (See Table 1 for an example.) Failure on the part of the subject to complete the response when the trainer had provided partial physical guidance resulted in the subject's returning to the previous step for five consecutive correct trials. A correct response on a new step of the program resulted in going to the next higher-numbered step on the next trial.

Each random sequence consisted of 10 training trials presented in a random order. On five of these trials, the trainer would present the verbal instruction for the behavior on which a subject was being trained. On the other five trials, the verbal instructions for behaviors that the subject had previously learned were presented.

Training

The training sequence (see Figure 1) consisted of conducting a probe sequence on the first three behaviors on a subject's List of Be-

Table 1

Breakdown of behavior "raise your hand" into small steps for putting-through procedure.

<i>Steps</i>	<i>Trainer Behavior</i>	<i>Decision</i>
		Terminal Position—Subject has hand raised above level of shoulder Reinforce
1.	Move arm and hand to appropriate position and hold it there	
2.	Move arm and hand upward to appropriate position	Release hand if S keeps it there—reinforce
3.	Move arm and hand upward $\frac{3}{4}$ way	Release hand if S raises hand—reinforce
4.	Move arm and hand upward $\frac{1}{2}$ way	If S raises hand—reinforce
5.	Get arm and hand started upward	If S raises hand—reinforce
6.	Touch S's hand	If S raises hand—reinforce
7.	Reach toward S's hand	If S raises hand—reinforce
8.	Give verbal instructions	If S raises hand—reinforce
Starting Position—Subject seated with hands in lap		

To carry out any step, the trainer starts with the behavior listed for Step 8 and moves backwards through the numbered sequence until completing the behavior for the step he is working on. For example, for Step 1, the trainer would have completed a smooth sequence of behavior going from Step 8 to 7, 6, 5, 4, 3, 2, and 1.

haviors to be Trained. From there, the subject went to (1) the next probe sequence if the behavior at the top of the list was performed correctly on all three probes, (2) training trials if the first behavior was performed correctly on one or two trials of the probe sequence, or (3) the appropriate putting-through procedure if the subject made no correct responses on the behavior at the top of his List of Behaviors to be Trained during the probe sequence. After making 10 consecutive correct responses in the last step of the putting-through procedure (verbal instruction only), the subject went to a random sequence. The subject was presented three random sequences over three sessions (one per session). A correct response on the target behavior on 14 of 15 trials in the three random sequences resulted in the behavior trained being considered learned. If the subject made an error on a random sequence, a physical prompt was given. A second error resulted in the subject's returning to the last step of the appropriate putting-through procedure for five consecutive correct responses. After a behavior met the criterion of 14 of 15 correct on random sequences, the next three behaviors at the top of the list of Behaviors to be Trained were probed, and the cycle would start over.

All correct responses during probe sequences, regular training trials, putting-through trials, and random-sequence trials were followed by contingent delivery of social praise and ice cream.

Starting with Session 84, review trials were introduced to help alleviate the need for retraining. The subject was given one trial on each of five learned behaviors during each session. The behaviors reviewed rotated randomly from session to session to assure that all learned behaviors were reviewed. Three behaviors were retrained a second time ("Raise your hand", "Touch your knee", and "Fold your arms").

Final Probing

After all 25 training items had been trained, final probes were given to determine which verbal instructions now controlled specific responses on the part of the subject, and what part of each verbal instruction controlled the subject's behavior. This was accomplished by conducting two randomly presented trials on different variations of each instruction (see Table 3). On a variable schedule, about every fourth trial consisted of a complete verbal instruction, variations of which were not being probed during that session. Correct responses to these complete

Fig. 1. Condensed flow chart of Instruction-Following Program starting at a probe sequence and ending with a random sequence.

verbal instructions were reinforced. Some of the variations were not feasible with some items, and are reflected in the denominators of the proportions presented in Table 3. A response was considered correct if the subject performed (1) any response that had been trained to a specific verbal instruction of which the presented variation was an integral part during

training, or (2) a response that was appropriate for the specific verbal stimulus.

RESULTS

Figures 2 and 3 show the percentage of correct responses to probe sequences for the first and last three behaviors on the subject's List of Behaviors to be Trained respectively. In addi-

Fig. 2. Percentage of correct responses to probes and random sequences for first three behaviors on subject's List of Behaviors to be Trained. Dotted line indicates point at which training began.

tion, these figures provide some samples of the multiple baseline data. The subject responded correctly on all three trials of a probe sequence for three behaviors. No other correct responses

occurred during any probe sequence. Only two correct responses occurred on training items on the daily unreinforced probes.

Table 2 shows the percentage of correct responses to each instruction during the initial baseline and final probes. Correct responses occurred on three verbal instructions on all days of the initial baseline and on 23 of 25 training items during the final probe sessions. No correct response occurred on any generalization item during either the initial baseline or final probes. Correct responses occurred on daily probes for only one generalization item (four correct of 21).

After both "Point to ear" and "Point to shoe" had been trained to criteria, the subject consistently performed one or the other of the behaviors correctly, but would not perform both correctly. In essence, the subject seemed to respond on the basis of the words "Point to" without discriminating between "ear" and "shoe". He often responded to the instruction that had been reinforced last. To establish a discrimination between the two instructions, the total instruction "Point to shoe" was emphasized

Fig. 3. Percentage of correct responses to probes and random sequences for last three behaviors on subject's List of Behaviors to be Trained. Dotted line indicates point at which training began.

Table 2

List of Behaviors to be Trained in the order trained and percentages of correct responses to each instruction during the initial baseline and final probes.

<i>Training Items</i>	<i>Initial Baseline</i>	<i>Final Probes</i>	<i>Generalization Items</i>	<i>Initial Baseline</i>	<i>Final Probes</i>
Stand up*	100	100	1. Point to hair	0	0
Sit down*	100	100	2. Brush shoe	0	0
Brush hair*	100	100	3. Lift car	0	0
1. Drink from glass	17	100	4. Push block	0	0
2. Raise your hand	0	0	5. Blow on ball	0	0
3. Clap your hands	0	100	6. Drop feather	0	0
4. Eat with spoon	0	100	7. Wave scissors	0	0
5. Drop ball	0	100	8. Hold out hand	0	0
6. Push car	0	100	9. Touch cheek	0	0
7. Touch your knee	0	100	10. Rub knee with washcloth	0	0
8. Fold your arms	0	0			
9. Lift block	0	100			
10. Open your mouth**	0	100			
11. Blow on feather	0	100			
12. Hold out scissors	0	100			
13. Fold hands	0	100			
14. Put on glove	0	100			
15. Wave your hand	0	100			
16. Rub cheek with washcloth	0	100			
17. Point to ear	0	100			
18. Point to shoe	0	100			
19. Point to nose	0	100			
20. Nod your head "yes"	0	100			
21. Shake your head "no"	0	100			
22. Stick out tongue	0	100			

*Behaviors considered learned during initial baseline.

**Started daily probes after Session 83 right after "open mouth" was learned.

(Risley and Reynolds, 1970) by being presented much louder. The instruction "Point to ear" was presented at a normal level by the trainer and was interspersed randomly with trials in which "Point to shoe" was emphasized. As the subject learned to discriminate by responding correctly, the emphasis was faded out on one word at a time. First, the emphasis on the word "point" was returned to normal level, then the emphasis on the word "to" was faded out, and so on. The subject had no difficulty learning to discriminate the command "Point to nose" after he had been taught to discriminate between "Point to shoe" and "Point to ear".

Table 3 provides a summary of the final probe data for all variations of each verbal instruction, including an analysis of the types of errors made. The degree of behavior controlled by the different variations of the verbal instructions

differed. One variation that controlled an extensive amount of behavior was when the verb was moved from the first to the last position in the verbal instructions. When the verbal instruction consisted of only two words, the subject carried out the instruction correctly in all cases where the verb was last. When three- and four-word instructions were given, his responses were less consistent. The noun only, the noun plus the pronoun or preposition, and (during the second trial) the verb only, also controlled correct responses on about 50% of the trials presented. The other variations of the verbal instructions seemed to be operating at or below a chance level. With four objects on the table for each trial, the subject could perform the response associated with one of those objects on each trial and could have performed correctly on about 25% of the trials.

Table 3

Summary of final probe data for all variations of each verbal instruction including an analysis of the types of errors made—all data presented in proportions.

<i>Verbal Stimuli</i>	<i>Trial</i> s	<i>Correct Re-sponses</i>	<i>Total Errors</i>	<i>Error Analysis</i>			
				<i>Correct Object or Body Part but Wrong Action</i>	<i>Correct Action but Wrong Object or Body Part</i>	<i>No Re-sponse</i>	<i>Wrong* Action and Object or Body Part</i>
Complete Verbal Instruction	1	20/22	2/22	1/2	1/2	—	—
	2	20/22	2/22	1/2	1/2	—	—
Verb Only	1	4/22	18/22	4/18	—	11/18	3/18
	2	9/22	13/22	2/13	—	6/13	5/13
Noun Only	1	11/22	11/22	—	—	2/11	9/11
	2	9/22	13/22	—	—	2/13	11/13
Verb plus Pronoun or Preposition	1	3/18	15/18	3/15	—	11/15	1/15
	2	5/18	13/18	—	—	11/13	2/13
Pronoun or Preposition Plus Noun	1	8/18	10/18	—	—	3/10	7/10
	2	7/18	11/18	—	—	3/11	8/11
Pronoun or Preposition Only	1	0/18	18/18	1/18	—	10/18	7/18
	2	0/18	18/18	—	—	2/18	16/18
Complete Verbal Instruction With Verb Last	1	8/22	14/22	3/14	1/14	3/14	7/14
	2	10/22	12/22	1/12	1/12	1/12	9/12
Complete Verbal Instruction with Different Noun	1	1/15	14/15	10/14	4/14	—	—
	2	1/15	14/15	10/14	4/14	—	—
Complete Verbal Instruction with Different Verb	1	3/20	17/20	9/17	7/17	—	1/17
	2	3/20	17/20	9/17	8/17	—	—

*72% of these errors are due to the subject performing the response "fold hands".

Each verbal instruction for generalization items consisted of a combination of a verb from one training item and a noun from a different training item (see Table 1). When the verbal instructions from a generalization item were given in the final probe, the subject always performed the behavior that had been associated with the noun during training, regardless of the action specified by the verb in the generalization item. For example, "Blow on feather" and "Drop ball" were training items, and "Drop feather" and "Blow on ball" were generalization items. When the instruction "Drop feather" was

given, the subject would blow on feather; and when instructed to "Blow on ball", the subject dropped the ball.

Reliability was collected on three sessions of the initial baseline, 10 training sessions, and on four sessions of the final probes. Reliability was obtained from a trial-by-trial comparison of the trainer and second observer's scoring of responses. Reliability was computed by dividing the total number of agreements by the sum of the total number of agreements plus the total number of disagreements. Reliability ranged from 93 to 100% with a mean of 98%.

DISCUSSION

The subject's performance shows that a useful relationship was established between 20 of 22 specific motor responses and the corresponding verbal instructions presented during training. The acquisition of the majority of instruction-following behaviors can be attributed to aspects of the training program. Whitman *et al.* (1971) also found increased performance to verbal instructions after training. However, they were not sure what variable accounted for the change in performance. The present results do not seem to be due to motivational problems or to acquisition of specific motor responses *per se*. Thus, it can be concluded that the subject learned to make specific responses in the presence of specific stimuli.

Whitman *et al.* (1971) found extensive generalization to behaviors that were not trained (generalization items) when training on other behaviors did occur. The subject in this study did not respond correctly to generalization items as a function of training on other behaviors.

The fact that during the final probes only four of eight variations in the verbal stimuli of instructions controlled specific responses also supports a conclusion that the subject learned to make specific responses in the presence of specific stimuli. Why the subject performed the expected response in all cases when the action word was last in two-word (noun-verb) instructions, but not in all cases when three- or four-word instructions were given, is unclear; however, it might be that additional words (pronouns, prepositions) add only confusion rather than functionality. Shipley *et al.* (1969) found that nontelegraphic (one-word utterances) speakers did best in performing one- and two-word commands, whereas telegraphic speakers did better at well-formed commands. It is possible that the present subject was at a level of language development similar to that of the nontelegraphic speakers in the Shipley *et al.* (1969) study. Thus, the subject performed correctly when word order was reversed

for two-word instructions, but did not do as well for three- and four-word instructions where irrelevant stimuli (words) were present.

In summary, it can be said that the subject learned to make specific responses in the presence of specific verbal stimuli; however, he did not learn a generative skill, in that each instruction needed to be trained. To train an individual to follow each possible individual instruction could take forever. Thus, it would seem more useful to train the subject on an individual concept until the subject generalized this concept to new combinations before going on to the next concept. Eventually, generalization might start to occur on the second verbal instruction on which a concept appeared; *e.g.*, one might train a subject to make a throwing response each time the word *throw* was presented. One would train the subject to perform a different action on a verbal instruction only after the subject started to throw items the first time the word *throw* was presented in verbal instructions with these items. After the subject had been trained to perform several different actions using such a procedure, he might well start generalizing so that he would perform a behavior to new verbal combinations without additional training, after having been trained to perform that response with one item.

REFERENCES

- Risley, T. R. and Reynolds, N. J. Emphasis as a prompt for verbal imitation. *Journal of Applied Behavior Analysis*, 1970, 3, 185-190.
- Shipley, E. F., Smith, C. S., and Gleitman, L. R. A study in the acquisition of language: free response to commands. *Language*, 1969, 45, 322-342.
- Striefel, S., Eberl, D., and Gast, D. *Individual differences among subjects in acquisition and generalization of imitation training*. Parsons Research Center Working Paper No. 287, Parsons State Hospital, Parsons, Kansas, 1972.
- Whitman, T. L., Zakaras, M., and Chardos, S. Effects of reinforcement and guidance procedures on instruction-following behavior of severely retarded children. *Journal of Applied Behavioral Analysis*, 1971, 4, 283-290.

Received 28 February 1973.

(Revision requested 21 May 1973.)

(Final acceptance 11 July 1973.)