*THE ROLE OF SOCIAL AND MATERIAL REINFORCERS
IN INCREASING TALKING OF A DISADVANTAGED
PRESCHOOL CHILD¹*

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Adult social reinforcement and access to materials in the preschool were made contingent on the verbalizations of a 4-yr-old Negro girl with an extremely low frequency of talking. Though the teachers' social attention was always given immediately for all spontaneous speech, if the child's spontaneous verbalizations were requests for materials, those materials were withheld until she had responded to the teachers' questions about those materials. When she was silent, the teachers withheld their attention and the materials. A high frequency of verbal behavior was quickly established. When both teacher attention and materials were provided only when the child was not verbalizing, the child's frequency of talking immediately decreased. When social attention and materials were again made contingent upon spontaneous speech and answering questions, the child's frequency of talking quickly increased to its previous high level. The content of the child's verbal behavior which increased was primarily a repetition of requests to the teachers with little change noted in the non-request verbalizations, or verbalizations to other children. A further experimental analysis demonstrated that social interaction *per se* was not the reinforcer which maintained the increased verbalization; rather, for this child, the material reinforcers which accompanied the social interaction appeared to be the effective components of teacher attention.

Children in an economically deprived area lack many skills which would enable them to function effectively in the public schools or in the middle-class society, of which public schools are an integral part. The most damaging deficiency appears to be a lack of verbal and language skills (Bereiter and Engelmann, 1966), whereby the child learns what the school has to teach and communicates what he has, or has not, learned. Consequently, most people interested in remediating the effects of cultural deprivation are concerned with increasing the language skills of these children. In view of this concern with the value

of verbal skills for economically deprived children, it was felt that an especially low frequency of verbal behavior by one such preschool child should be altered. Previous studies utilizing operant conditioning procedures have demonstrated how a manipulation of this nature could be undertaken. The pioneering studies from the University of Washington Preschool have investigated the applicability of operant principles to changing the problem behavior of normal children in naturally occurring situations (summarized in Harris, Wolf, and Baer, 1964). These studies, which investigated the relationship between the behaviors of teachers and the behaviors of preschool children, have indicated that the "attention" of the teacher can function as a strong reinforcer to establish, modify, and maintain the behavior of preschool children.

This development has provided information about principles of behavior and how these principles affect human behavior. It has also provided a technology for therapeutic intervention in human problems and for increasingly more sophisticated analyses of human behavior. The present study was undertaken to increase the frequency of verbal-

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ization of a child in a preschool setting and subsequently to analyze the controlling components of the teacher-child interaction in producing the behavior increase, as well as to assess some of the changes in the content of verbalizations in relation to changes in the frequency of verbalizations.

METHOD

Subject and Setting

The study was conducted at the Turner House preschool of the Juniper Gardens Children's Project in Kansas City, Kansas. The subject was a 4-yr-old girl who exhibited a low frequency of verbal behavior well after the period considered normal for adaptation to the preschool routine and setting. She was one of 15 children, all Negroes from a lower class community, selected from large families with extremely low incomes. The subject's Peabody Picture Vocabulary Test I.Q. was 59, slightly below the average (79) of the group, but she did not appear retarded. She gave appropriate answers in structured teaching situations if the teachers could get her to speak loud enough to be heard. She was particularly skilled in motor activities, and despite her non-verbal method of obtaining play materials from other children ("grabbing"), appeared well-liked by the other children.

The preschool ran from 8:30 to 11:30 a.m. five days a week. During the first 45 min of the morning, special training programs and individual tasks for the children were combined with breakfast. The remainder of the morning consisted of an approximately 45-min period of free play inside, a 30-min snack and instruction time, a 45-min period of free play outside, and a story time inside just before going home.

During free-play periods, the children could move from one to another of the unstructured activities usually found in preschool programs such as a block area, a doll area, a painting area, or a sand box. Some materials such as blocks were available to the children, and others such as paint were dispensed by the teachers. During the free-play periods, the three teachers always attended to, talked to, and interacted with the children and occasionally provided snacks (fruit, cookies, crackers, *etc.*) contingent upon generally appropriate play behavior.

PROCEDURES AND RESULTS

Recording

Three observers recorded data during the morning free-play periods, and although present in the preschool room and yard with the children, did not interact with or respond to them. Observations of the subject were made at sample intervals only during free-play periods. During these periods the child's speech was sampled using two different recording procedures, one recording how often she spoke and one recording what she said.

Frequency of verbalization. Verbal frequency data were collected simultaneously by all three observers. They carried data sheets similar to those described by Allen, Hart, Buell, Harris, and Wolf (1964) and Hall, Lund, and Jackson (1968). Each row of the data sheet contained 30 squares representing a 10-sec interval per square, or 5 min per row. Two adjacent rows were used for each 5-min observation. The top row was used to record talking or verbalization by the child. Whenever the child verbalized during a 10-sec interval a (T) was written in the square corresponding to that interval. Only one (T) was marked in any interval during which the child verbalized irrespective of the amount of talking that occurred in that 10-sec period. If the child's verbalization began in one 10-sec interval and extended into the next, a (T) was noted in both intervals. Frequency of verbalization was therefore recorded as the per cent of 10-sec intervals of the sample during which verbalization occurred. The bottom row was used to record teacher attention by placing the initial of the attending teacher in the square corresponding to the 10-sec interval in which teacher attention occurred. Teacher attention was counted in the same way as verbalizations by the child.

Starting at the same time, using stopwatches, the three observers simultaneously but independently recorded the frequency of the child's verbalizations for 5-min periods. Usually, three such 5-min samples were taken each day during the two free-play periods: two during the first free-play period and one during the second, although occasionally only one or two 5-min samples were taken during a day.

Verbalizations were defined as any speech from the child heard by the observers,

except random noises such as shrieking, humming, or laughing. During rate samples, speech which was too low for the observers to understand fully was counted, though this was not true of the content samples. Teacher attention was counted as any time a teacher spoke to, gave equipment to, or touched the child.

The correspondence between the three observers' data on frequency of verbalization is shown in Fig. 1, where the top line represents the highest rate and the bottom line the lowest rate obtained by an observer on a given sample. The product-moment correlation coefficients between the frequency data of the three observers on all observations throughout the year were:

0.97 for observers A and B (64 samples)
0.96 for observers A and C (59 samples)
0.99 for observers B and C (59 samples).

The product-moment correlation coefficients between the teacher attention data over the same samples were:

0.85 for observers A and B (64 samples)
0.90 for observers A and C (59 samples)
0.97 for observers B and C (59 samples).

Content of verbalization. The content of verbalization samples were collected over the same portions of the year as the frequency of verbalization samples, but not necessarily on the same days. The verbal content samples were recorded during free play by one of three observers, who wrote down in longhand "everything" that the child said while following her from one activity to another during a 15-min period. Twenty-nine such samples were taken on different days during the baseline condition (Days 1 to 29), 7 by observer A, 13 by observer B, and 9 by observer C. During the experimental conditions (Days 130 to 164) observer A recorded all 30 verbal content samples, with observer B simultaneously recording on two occasions (Days 157 and 162). These verbalization records were then transcribed and content was categorized and counted from the transcribed phrases by one teacher. As observers recorded the data, they also put a check in one column if the verbalization was directed toward a child, and a check in a second column if it was directed toward a teacher (immediately following a recorded verbalization). General grammatical

rules were used to categorize roughly the content of the verbalizations. As the nouns and verbs were counted, the first appearance of a noun or a verb was added to the count of *different* nouns and verbs. Each subsequent time the child said that noun or verb in the same content sample, it was counted as a repetition. The phrases were also defined as sentences if they included a subject (or implied subject) and a verb. These sentences were then categorized as *mand*, generally a request, demand, or question which specified the reinforcer (Skinner, 1957), or *non-mand* sentences. Sixteen of these verbalization records (randomly selected but including at least two from each condition) were independently categorized and counted by the second teacher.

The averages of the content measures from each observer's records during the baseline period are compared in Table 1. The correspondence between the measures taken from the three observer's records indicates the re-

Table 1

Comparison between the three observers' records of the content of the child's speech during baseline (average frequency per sample).

	Observer		
	A	B	C
Nouns and Verbs:			
Total	10.0	8.6	12.3
Different	4.6	5.5	6.9
Verbalizations:			
To teacher	3.8	2.8	5.3
To child	4.8	11.0	5.8
Verbalizations:			
Mands	6.6	3.6	5.4
Non-mands	0.02	3.4	1.0

liability of the low frequencies of the content measures between different observers on different days. On the two occasions of simultaneous recording, observer A recorded 12 different nouns and verbs with 37 repetitions and observer B recorded 11 different and 22 repetitions on Day 157; observer A recorded 16 different and 58 repetitions and observer B recorded 14 different and 43 repetitions on Day 162. On the 16 samples categorized by the second teacher, the product-movement correlation coefficients between the scores of the two raters were 0.99 for nouns and verbs, and

mand sentences and 0.95 for non-mand sentences.

Experimental Conditions

The following contingencies and experimental manipulations were in effect throughout the entire free-play periods, which usually totaled close to 1.5 hr each day:

A. Baseline.	(Days 1 to 129)
B. Teacher attention contingent on verbalization.	(Days 130 to 142)
C. Teacher attention contingent on non-verbalization; differential reinforcement of other behavior (DRO).	(Days 143 to 148)
B. Teacher attention contingent on verbalization.	(Days 149 to 154)
D. Modified teacher attention contingent on verbalization.	(Days 155 to 161)
B. Teacher attention contingent on verbalization.	(Days 162 to 163)

A. Baseline. During the first 129 days that the child was in school, verbalizations occurred during an average of 11% of the 10-sec intervals of each sample, ranging between 1% and 32% on individual samples. Teacher attention during that time ranged between 0% and 36% with an average of 11%. Data between Days 31 to 45, 65 to 78, and 119 to 129 are shown in Condition A of Fig. 1.

B. Teacher attention contingent upon verbalization. From Day 130 through 142, the teachers' attention to the child was contingent upon her verbalizations and was maintained while she was talking. Teacher attention consisted of a variety of stimuli which included one or more of the following: praising the child, asking her questions, giving her equipment, assisting her, attending to, talking to, and providing a requested object or material. The form of the teacher attention varied

Fig. 1. The per cent of 10-sec intervals during which talking occurred. The experimental conditions were: (A) Baseline. (B) Teacher attention contingent upon any verbalization. (Social interaction immediately contingent upon all verbalizations; access to materials contingent upon responding to variable number of questions whenever verbalizations were requests for materials.) (C) Teacher attention contingent upon silence (DRO). (D) Teacher attention contingent upon any verbalization (Social interaction immediately contingent upon all verbalizations; materials immediately contingent upon requests). The two lines on the graph represent the highest and lowest scores of the three observers. The dots in the lower portion of the graph mark those days when observations were made by only two observers.

according to the context of the child's verbalizations and the nature of the situation. However, whenever the child's verbalization was in the form of a request for materials, the teacher would ask questions about the materials or the child's projected use of the materials. The material itself would only be given contingent upon the child's responding to one or more such questions. For example, if the child said that she wanted to paint, the teacher would praise her for saying what she wanted, and then ask her what she was going to paint or what other things she needed in order to paint, *e.g.*, brush, paper. Again they praised her for any verbal responses she made and perhaps asked her another question. This was continued as long as the teacher could ask reasonable or logical questions concerning the situation; it usually ranged between one and three questions per request for materials, though occasionally no questions were asked. Thus, while teacher attention in the form of social interaction was given contingent upon each instance of verbalization, whenever the verbalization was a request for materials, teachers' interactions were in the form of asking questions about the materials and the materials were dispensed on a small variable

ratio for answering questions. When possible, teachers required the child to ask for materials by preventing her free access to them.

During the 13 days of these conditions, the frequency of the child's verbalization increased from 11% to 75% of the 10-sec intervals (Condition B, Fig. 1). The number of nouns and verbs used increased from an average of 15 (range 3 to 25) to an average of 46 (range 14 to 73) per 15-min content sample. The number of different nouns and verbs used per sample increased from an average of seven to an average of 16 while the frequency of repetitions increased nearly twice as much from an average of seven to an average of 30 (Condition B, Fig. 2).

The number of verbalizations directed to a child remained approximately constant (changing from an average of 7.6 to 7.9) while the number of verbalizations directed to a teacher increased from an average of 4.2 to 26.8 during this period (Condition B, Fig. 3). The number of *non-mand* sentences remained approximately constant (changing from an average of 2.3 to 2.6) while the number of *mand* sentences increased from an average of 4.2 to 19.5 during this period (Condition B, Fig. 4).

Fig. 2. Frequency of nouns and verbs during periodic recording of the child's speech. The conditions correspond to the conditions described in Fig. 1.

Fig. 3. Frequency of statements to teachers and to other children during recording of the child's speech. The conditions correspond to the conditions described in Fig. 1.

Fig. 4. Frequency of *mand* and *non-mand* sentences during periodic recordings of the child's speech. The conditions correspond to the conditions described in Fig. 1.

In summary, the marked increases in frequency of verbalizations were almost entirely a function of an increase in the frequency of requests (*mands*) to the teacher (usually for materials). These increased requests involved the use of a slightly greater vocabulary than before but a proportionately greater increase in repetitions of the same words.

C. *Teacher attention contingent on non-verbalization (DRO)*. Since the frequency of teacher attention was now higher, it became necessary to investigate whether the increased instance of teacher attention, *per se*, or the contingency of presenting teacher attention immediately after the child verbalized was maintaining the verbal rate. It might be said that the child verbalized at a higher frequency simply because the teachers were attending and talking to her more, indicating that the higher incidence of teacher attention rather than its contingency of following the child's verbalizations was maintaining this frequency. Therefore, the teacher attention was maintained at as high a rate but was now made contingent upon non-verbalization by the child. Typically the teachers would attend to the child, praising her and providing her with

materials while she was silently engaged in activities. For example, if the children near the child were asking for water and she picked up a cup, the teacher would reinforce the child's behavior of not asking by pouring water into her cup and keeping it filled as long as she was silent, and praising her for pouring from her cup, working hard, and keeping busy. The teachers removed their attention and the supplying source of materials for 15 to 30 sec immediately following a verbalization by the child. (This procedure is often described as differential reinforcement of other behaviors, [DRO], since teacher attention is presented contingent upon any behavior except the behavior being measured, in this case talking.)

During six days of DRO, the rate of verbalization dropped from an average of 46% to 6% while the rate of teacher attention was maintained at an average of 67% (Condition C, Fig. 1 and 5). At this point, teacher attention was again given contingent upon verbalization by the child. Her frequency of verbalization immediately increased to an average of 51% during the four days of this condition, while the rate of teacher attention averaged 47% (Condition D, Fig. 1 and 5).

Fig. 5. The relationship between teacher attention and talking by the child. The conditions correspond to those described in Fig. 1.

During DRO, several aspects of the child's verbal content dropped well below the baseline level. The number of total nouns and verbs used dropped to an average of four per day. The amount of talking decreased to the point that little verbalization was made to either teachers or children, though the amount of talking to teachers was higher at an average of three per day, but only one per day to children.

D. Modified teacher attention contingent on verbalizations. The DRO condition demonstrated the function of the gross category of teacher attention in maintaining the child's increased rate of verbalization. However, the analysis of the content of the verbalizations, which revealed that the increase was primarily in repeated requests to the teachers for materials, indicated that the praise and social interaction components of the teachers' attention might not be functional. Therefore, a further manipulation was made to analyze experimentally the functions of the two components of teacher attention: the teachers' praise and social interaction, and the teachers' questioning the child and requiring additional verbalizations before providing a requested material.

After recovery from DRO, for six days social interaction with the teacher remained exclusively contingent upon verbalization, but questioning the child and requiring further verbalization before providing any requested material to the child was discontinued. Now she could immediately acquire materials by asking for them, rather than being required to respond verbally to questions in order to get them. Under these conditions, the child's frequency of verbalization gradually declined from 61% to 28% of the 10-sec intervals (Condition D, Fig. 1). Since teacher attention was given only after verbalization by the child, it too dropped along with the frequency of verbalization (Condition D, Fig. 5). *Non-mand* sentences, different nouns and verbs used and verbalizations to children remained relatively stable, while *mand* sentences, repetitions of nouns and verbs, and verbalizations to teachers decreased systematically (Condition D, Fig. 2, 3, and 4).

When the teachers again asked questions and required several responses from the child before providing her with requested materials during the following two days (the final two days of school), the rate of verbalization im-

mediately increased from 29% on the last day of Condition D to an average of 67% (Fig. 1 and 5). The number of repetitions of nouns and verbs, verbalizations to teachers, and *mands* all increased to a level comparable to the previous periods in which these conditions were present (Fig. 2, 3, and 4).

DISCUSSION

In the present study, a child's low frequency of verbal behavior was increased, utilizing the techniques of consequent teacher attention. This increase was reversed and recovered by altering the contingent relationship between teacher attention and verbalization. Thus, this study consisted in part of a replication of prior preschool studies showing that contingent teacher attention can effectively alter yet another behavior of the preschool child.

Teacher attention includes a variety of behaviors such as looking at, smiling at, talking to, touching, providing materials for, and assisting the children, only some of which may be functional in altering or maintaining the behavior of a child. In studies utilizing teacher attention as a consequence for children's behavior, the form of the teacher attention varies from instance to instance according to the activity in which the child is engaged and the content of the child's verbalizations. Therefore, to a large extent, the child's behavior determines the form of the teacher's attention. In the present study, the criterion behavior, verbalization, appeared primarily in the form of a request for materials. The teacher's attention, therefore, almost always included providing the child with materials.

Both the DRO procedures and the fact that the majority of the child's verbalizations were directed toward teachers indicated that the teachers were in fact controlling the relevant reinforcers. However, the fact that the majority of the child's verbalizations were *mands* (primarily, requests for materials) indicated that the strictly social interaction components of teacher attention were perhaps not the functional components. The DRO contingency provided no information on this question since social interactions, questions, and access to materials were simultaneously altered. The subsequent manipulation, in which access to materials no longer entailed answering a series

of the teachers' questions, resulted in a steady decline in the child's frequency of verbalization. This decline occurred in spite of the fact that social interaction was still contingent upon each instance of the child's verbalization and materials were immediately contingent upon those verbalizations which were requests for materials. This demonstrated that the social interaction *per se* was not the reinforcing component of teacher attention that maintained the high rate of verbalization. The important component of teacher attention was questioning the child and requiring several verbal responses before allowing access to materials. Time did not permit a further experimental analysis to separate the two obvious aspects of this functional component of teacher attention: the questioning *per se* and the ratio scheduling of access to materials. However, the facts that the questioning occurred only when the child requested materials and the child usually responded to the questions by simply repeating her original request rather than "answering" the question, and that most of her increased verbalizations were *mands* indicate that the ratio scheduling of access to materials through the teacher was critical to establishing and maintaining a higher rate of verbal behavior. This child could get few materials or equipment without first obtaining the teachers' attention. Only when the teachers' attention "mediated" access to materials did it function as a reinforcer for this child's verbalization. A similar procedure (of allowing access to materials contingent upon certain forms of speech) but without the prompts or questions proved to be functional in altering the speech of the other children in the preschool (Hart and Risley, 1968).

In work with culturally deprived preschool children, the teachers have informally observed that these children's verbalizations contain relatively few descriptive or informative statements, but a large proportion of commands and requests. Bereiter and Engelmann (1966) have reported similar observations. The high frequency of requests may indicate that material reinforcers are disproportionately strong, or that social interaction with adults is a disproportionately weak reinforcer, and that adults may be important primarily as dispensers of material reinforcers. Such appeared to be the case for this child. However, since the previous studies utilizing

adult attention as a reinforcer (summarized in Harris *et al.*, 1964) did not analyze the components of attention which were functional in producing changes in the behavior of middle class preschool children, material reinforcers may have, in fact, been the functional aspect of the teacher attention for those children as well.

In an analysis of the effect of a behavioral manipulation, usually the rate of only one aspect of the behavior is considered. A concurrent analysis of other aspects of the studied behavior allows a more detailed specification of the effect of the functional variables. In this study, as the frequency of the child's talking increased, the data on the content of verbalization revealed that the increase involved primarily an increase in verbalizations to teachers in the form of repetitions of the same nouns and verbs in *mand* sentences.

With additional time, access to materials might have been applied to alter the content of this child's speech. However, before considering differential reinforcement of the content of verbalization, it seems essential to obtain a high stable frequency of verbalization. The data indicated that the teachers could control the rate of verbal behavior. Once this high frequency was obtained, it would have been possible to provide access to materials differentially contingent upon *non-mands*, child-directed speech, or variety of nouns and verbs. The nature of such differential reinforcement procedures, their success, or even their necessity, are questions for further investigation.

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