The Shaping of Verbal Imitation and Multiple Effects of Aversive Schedules for Controlling Inattention in an Infant

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THE SHAPING OF VERBAL IMITATION AND MULTIPLE EFFECTS OF AVERSIVE SCHEDULES FOR CONTROLLING INATTENTION IN AN INFANT

by

Leta Hunt Secker

A Thesis Submitted to the Faculty of The Graduate College in partial fulfillment of the Degree of Master of Arts

Western Michigan University Kalamazoo, Michigan April 1973
A six-month-old infant was conditioned to imitate four verbal cues presented by an adult experimenter by using food as a reinforcer. Aversive schedules (escape-avoidance of, or punishment with a loud buzzer) were then introduced to suppress inattentive behavior. Inattention defined as looking away from the investigator, crying, rate of vocalizations, and accuracy of imitations were measured. Three conclusions of the experiment were: 1) verbal imitation can be shaped and maintained through positive reinforcement; 2) the use of aversive schedules effectively reduces inattention; 3) the use of such aversive schedules is not necessarily beneficial for the performance of the imitative task, or for the general well-being of the child.
ACKNOWLEDGEMENTS

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For these things I am most grateful.

Leta Hunt Secker
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>INTRODUCTION ................................................. 1</td>
</tr>
<tr>
<td>II</td>
<td>GENERAL METHOD ............................................. 3</td>
</tr>
<tr>
<td></td>
<td>Subject ....................................................... 3</td>
</tr>
<tr>
<td></td>
<td>Apparatus ..................................................... 3</td>
</tr>
<tr>
<td></td>
<td>General Procedure ........................................ 5</td>
</tr>
<tr>
<td>III</td>
<td>DISCUSSION OF CONDITIONING ........................... 10</td>
</tr>
<tr>
<td>IV</td>
<td>RESULTS OF THE PUNISHMENT AND ESCAPE AVOIDANCE PROCEDURES ........................................ 12</td>
</tr>
<tr>
<td>V</td>
<td>DISCUSSION OF ESCAPE AVOIDANCE AND PUNISHMENT PROCEDURES ........................................ 14</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>......................................................... 24</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

Verbal behavior has been conditioned in a number of contexts. Greenspoon (1955) was one of the first to demonstrate a reinforcement theory analysis of verbal behavior involving an experimental setting and described in objective terms. Using an observer response ("mmm-hmmm") to reinforce the subject for emitting a particular class of words, Greenspoon was able to increase the frequency of the subject's reciting plural nouns as opposed to all other classes of words. Since that time, other experimenters have successfully used operant conditioning to modify or produce verbal behavior in adult human subjects (Verplanck, 1955; Goldiamond, 1965; Azrin, Jones & Flye, 1968; Webster, 1970), children (Hart & Risley, 1968; Peterson, 1968; Burgess, Burgess and Esveldt, 1970), and even chimpanzees—though of another topography (Premack, 1970). In fact, it is possible to counter-condition supposed experimenters by giving them information on expected results (Azrin, Holz, Ulrich & Goldiamond, 1961; Ulrich, 1962) or by employing "more aware" subjects (Rosenfeld & Baer, 1969, 1970). Many of these experiments have employed an individual-organism type of analysis and have reported the effects of specific procedures on the verbal behavior of individual subjects.

Research involving the verbal behavior of very young infant humans has not usually taken the same form. Many studies have shown
that infants can be operantly conditioned to emit sounds (Rheingold, Gewirtz, and Ross, 1959; Weisberg, 1963), or to emit specific sounds more than others (Routh, 1969). These experiments generally involve a "baseline," an "experimental treatment condition," and some sort of "return to baseline" procedure. The data of such experiments on infant vocalization have been reported as group means, however, and therefore an analysis of the environmental variables influencing the behavior of individual subjects is not available.

The present experiments were designed to yield an experimental analysis of verbal imitation (and related behaviors) of one infant who was exposed to several experimental conditions over a long period of time.
CHAPTER II

GENERAL METHOD

Subject

An infant girl (six-months-old at the start of the experiments) was the subject. The child came from the family of a university professor, and had an older brother (six-years-old) and an older sister (five-years-old). The subject had not been exposed to any systematic verbal conditioning prior to the start of the experiments.

Apparatus

The baby was securely seated in an infant chair, which was tied to a large folding chair (Figure 1). The baby and the experimenter faced each other at slight angles. An electric counter (Layfayette Instrument Company, model 570PS) and a Breitling stop watch were used to count reinforced vocalizations and time session length. A Wollensack 3M portable tape recorder was used to record sessions. These objects, as well as reinforcers, were on a card-table to the left of the experimenter. Food reinforcers consisted of milk, cereal mixed with milk and sugar, and baby food of colloid nature. A spoon, approximately 3/4" long and 1/2" wide, was used to feed the baby. A small dish contained the solid food, and an 8-oz. bottle contained the milk. Play reinforcers consisted of rocking and singing. During the punishment procedure, two additional
FIGURE 1

Diagram of equipment used during experiments. The items are:
A-buzzer (used only in Exp. II), B-hand control for counter (F),
C-foot pedal (used only in Exp. II to operate timer (H) and buzzer
(A)), D-infant seat, E-stop watch session timer, F-counter, G-tape
recorder, H-timer.
items were added. A running time meter (Model 20225 ADW) was placed on the table, and an electric buzzer (Potter and Brumfield BU AC 115 volts) which was enclosed in a 2-1/2" x 5" aluminum box was first placed on the table, but soon moved to directly under the experimenter's chin. The apparatus is shown in Figure 1.

Sessions were conducted in a 10' x 13' room. A large window on one side of the room allowed observation of the experiment. The baby was always seated with her back to this window.

General Procedure

Sessions were conducted at morning, noon and evening, seven days a week. Several exceptions occurred as a function of sickness, out-of-town trips, etc., so that, for example, the 230 sessions of conditioning were spread over a total of 12 weeks. Sessions always began with the food on the table and the baby securely fastened in the infant seat. The experimenter picked up the spoon, started the stop watch, picked up the hand counter and looked at the baby. With the exception of the first 35 sessions of conditioning, the experimenter always waited to give the verbal cue (the model vocalization, or response to be imitated) until the baby made eye contact. The same four cues were always used, and, after the initial shaping period where the cues were introduced gradually, all cues were presented to the baby with near-equal frequency. The four cues were: "ba," "ba, ba, ba," "ma," and "ma, ma."

Each time the baby correctly imitated the cue given by the experimenter she was given a drink of milk, a bite of food, or, in
some special cases, a few seconds of play. (This procedure also excludes the initial conditioning procedure where approximations to the correct response were often reinforced. Table 1 outlines the general shaping procedure.)

Some reactions of the experimenter to the baby's non-imitative behavior remained constant, for example, every time the child cried, the experimenter looked away from her and gave no verbal cues until crying had ceased. Sessions varied somewhat in length but averaged 15 minutes. After the baby had learned to imitate correctly all four verbal cues, aversive control was used to bring her attention (looking at the experimenter) under control. All four cues were presented randomly, but with equal frequency. Various phases are explained below in the order in which they were introduced.

Reinforcement Alone (R/A)

This procedure was identical to the procedure used in conditioning, except that a measure was taken of the amount of time the baby spent looking away from the experimenter. After food was given to the baby, she was always allowed a three-second "free-time" interval before the attention timer was started. A percentage of total session time spent looking away was calculated which excluded the three-second period that always followed reinforcement. Reinforced vocalizations per minute were recorded.
<table>
<thead>
<tr>
<th>Sessions</th>
<th>Procedures and Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-35</td>
<td>Baby reinforced for any discrete vocalization (excluding crying or whining) that followed the experimenter's verbal cue (&quot;Ah&quot;).</td>
</tr>
<tr>
<td>36-45</td>
<td>Emphasis was placed on the baby's attending to the experimenter, who never gave a cue until the baby made eye contact.</td>
</tr>
<tr>
<td>46-53</td>
<td>The baby was not given a verbal cue if she had her thumb in her mouth. Instead, the experimenter waited for eye contact, removed the baby's thumb, and immediately gave the verbal cue.</td>
</tr>
<tr>
<td>54-65</td>
<td>The experimenter introduced the sound &quot;ba.&quot; During this procedure, &quot;ba&quot; and &quot;ah&quot; were interspersed, and &quot;ba&quot; was presented in increasing frequency.</td>
</tr>
<tr>
<td>66-88</td>
<td>Due to some difficulty in conditioning &quot;ba,&quot; these sessions were devoted to imitation of the sound &quot;ah&quot; only. These sessions were also used to strengthen other responses, such as attention and no-thumb sucking: both of which had become progressively worse as a function of the previous attempts to condition &quot;ba.&quot;</td>
</tr>
<tr>
<td>80-166</td>
<td>&quot;Ma&quot; was conditioned through shaping involving successive approximations. Any &quot;ma&quot; sound, regardless of the number of times the baby emitted the syllable, was reinforced.</td>
</tr>
<tr>
<td>167-180</td>
<td>Baby was taught to distinguish &quot;ma&quot; from &quot;ma, ma.&quot; After completion of this procedure, the subject was only reinforced for producing the same number of &quot;ma&quot; sounds as given in the cue.</td>
</tr>
<tr>
<td>181-183</td>
<td>Attempts were again made to condition &quot;ba&quot; without the development of undesired behaviors. Food was found to not function effectively as a reinforcer, so &quot;ba&quot; was initially shaped with imitation-contingent physical contact. Reinforcers for correct &quot;ba&quot; imitations included rocking, holding, raising the baby into the air, singing, etc. Gradually these reinforcers were faced out, and only food reinforcers were given.</td>
</tr>
<tr>
<td>184-230</td>
<td>&quot;Ba, ba, ba&quot; was introduced. The baby learned to reproduce the cue the correct number of times. Finally all four cues were presented to the baby with equal frequency. The experimenter continued to reinforce only correct syllables and correct numbers of syllables.</td>
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</tbody>
</table>
Escape-Avoidance (E/A)

Procedures were equivalent to Reinforcement Alone conditions, except the buzzer was connected to the attention timer so that every time the timer was started, the buzzer sounded. Whenever the baby looked away from the experimenter after a "free period" had elapsed, the timer and buzzer were simultaneously activated with the foot pedal, and remained on until the baby looked at the experimenter. Thus, the buzzer could be escaped by looking at the experimenter once the buzzer had started, and could be avoided by looking at the experimenter before free-time had elapsed. For the first few sessions, the buzzer was located on the table. Thereafter, the buzzer was attached directly under the experimenter's chin (see Figure 1).

Reinforcement Alone

Same as first Reinforcement Alone condition.

Escape-Avoidance

Same.

Punishment (P)

The procedure was altered so that the buzzer was contingent upon looking away. Free-time was abolished so that any time the baby looked away from the experimenter during a session, the buzzer came on and remained on until the baby looked back at the experimenter.

Reinforcement Alone

Same. At this point in the experiment, as a function of observations of the child, some additional measures of her behavior were recorded. The procedures remained the same, except that the
following measures were taken: percent of session spent looking away, frequency of looking away (per minute), percent of session time spent crying, and reinforced vocalizations (per minute). During the last portion of this Reinforcement Alone phase, and during subsequent phases, these measures were taken. Free period was allowed before the no 3-second attention timer was started.

Punishment

Same with additional measures.

Reinforcement Alone

Same with additional measures.
CHAPTER III

DISCUSSION OF CONDITIONING

Initial conditioning of any response, human or animal, is often difficult to report. The difficulty lies in the degree of specification usually required in reporting, and the degree of flexibility on the part of the experimenter necessary for conditioning. Two congruities, however, became apparent as the conditioning process proceeded.

1. Consistently, the closest response approximations occurred at the end of the food sessions immediately prior to satiation, or directly before play reinforcement. At these times the baby was looking at the investigator, there was no crying, and the latencies between the model vocalizations and the imitations were long.

2. No response was successfully shaped at the beginning of a session. At these times the response rate was quite high, the responses were stereotyped, and ratio strain, evidenced by crying and thumbsucking, occurred after ratios of only two or three responses.

These observations appear to be contradictory to previous data which defines a "better" response as being characterized by a high rate and short latency between \( S^D \) and response (Keller and Schoenfeld, 1950). However, most of these data are concerned with the acquisition and maintenance of a stereotyped response such as a barpress. Such a response might occur periodically without specific shaping and not be analogous to the chain of neural and muscular events required to imitate a complex verbal \( S^D \) for the first time. Also, high deprivation states, while conducive to high response
rates, may not necessarily be conducive to improved discrimination or acquisition per reinforcement.

It is perhaps significant that after 1,018 food reinforcements over a period of thirteen sessions, no concrete approximations to "ba" were shaped, whereas the same terminal response was later shaped with only 25 play reinforcers over a period of three sessions.
CHAPTER IV

RESULTS OF THE PUNISHMENT AND ESCAPE AVOIDANCE PROCEDURES

1) Both escape-avoidance (E/A) procedures and punishment (P) procedures immediately decreased the percentage of session time spent looking away.

2) Both procedures increased the number of reinforced vocalizations.

3) The latency between onset of P and maximum decrement in looking away and concomitant increment in the rate of reinforced vocalization is longer than the same latency during E/A.

4) The highest percentages of time spent looking away always occurred during the R/A conditions that directly followed a P procedure. During the R/A phase immediately following the first E/A phase the percentage of time spent looking away quickly returned to a level near, though slightly lower than that recorded before the E/A phase. When the first P phase was ended and a percentage of time spent looking away immediately rose to one of the highest levels recorded during the previous phases.

When the second P phase was discontinued, the percentage of time spent looking away remained low for twelve sessions and then returned to a level again above that obtained in the
previous R/A phase.

5) The squints, jerks, and contortions first observed at the beginning of the P procedure became exaggerated during the first half of an R/A following a P. The baby would contort her face and pull her knees under her chin. These responses would occur immediately after reinforcement and/or concurrently with looking away. The subject would whine and open and close her fists almost continually during these sessions. These responses were never noted during E/A.
CHAPTER V

DISCUSSION OF ESCAPE AVOIDANCE AND PUNISHMENT PROCEDURES

Both escape-avoidance (E/A) procedures and punishment (P) procedures immediately decreased the percentage of session time spent looking away, as indicated in Figure 2. Similar reactions to punishment have been observed in lower animals by Azrin (1956, 1959, a b, 1960). Both procedures also increased the number of reinforced vocalizations. The latency, however, between onset of P and maximum decrement in looking away and concomitant increment in rate of reinforced vocalizations is longer than the same latency during E/A. There are at least two reasons for this. First, most of the looking-away responses occurred immediately after the baby had received reinforcement. In the E/A procedure, there was a three-second period immediately after reinforcement when looking away was not measured, both during baseline and the experimental procedures. Second, because of the three-second free period during the E/A contingency, much of the looking-away behavior did not result in presentation of the buzzer sound, whereas, during the P, all looking away responses were followed by the buzzer. The buzzer was thus presented more often and for longer periods of time during the initial portion of the punishment contingency. This produced great disruption, as evidenced by loud screams which probably were incompatible with attending.
FIGURE 2

Percentage of sessions spent looking away (top) and reinforced vocalizations per minute (bottom). Procedure changes are indicated in abbreviated form at the top of the Figure (see the key for complete phase titles). Dotted horizontal lines show the mean for each Phase.

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Another difference between effects of the E/A procedure and the P procedure is seen once these procedures were removed. When the first E/A phase was followed by a Reinforcement Alone (R/A) phase (beginning Session 251), percentage of time spent looking away quickly returned to a level near, though slightly lower than, that recorded before the E/A phase. When the first P phase was ended and a R/A phase re-instated (beginning Session 275), the effect was quite different. On Session 275, the percentage of time spent looking away immediately rose to one of the highest levels recorded during the previous phases. This is consistent with lower animal data (Azrin, 1960). From that session onward, the percentage of time spent looking away remained high. When the second P phase was discontinued (beginning Session 347), a different effect occurred. Instead of an immediate return to a very high rate, the percentage of time spent looking away remained low for many sessions. The enduring effects of punishment are well illustrated by this final R/A phase. It should be noted, however, that this effect of punishment did not last over twelve sessions (four days) and the percentage of time looking away soon returned to a level again above that obtained in the previous R/A phase. Again, it should be noted that the highest percentages of time spent looking away always occurred during the R/A conditions that directly followed a P procedure.

If a good session were arbitrarily defined as being a high rate of reinforced vocalizations, large percentage correct, low percentage of session time spent crying, and low frequency and
percentage of session time spent looking away, the optimal sessions occurred in the middle of P (Sessions 327-330). The baby correctly imitated the model vocalizations most frequently during R/A. The percentage correct, however, during the middle of P (Sessions 327-329), was comparable to that during R/A. The number of reinforced vocalizations per minute was highest during the middle of P (Sessions 323, 327-330). Also, the frequency and percentage of sessions time spent looking away were lowest during the middle of P (Sessions 323-347). The percentage of session time spent crying was least during R/A and in the middle of P (Sessions 326-330). When punishment first occurred, the baby spent a great deal of time crying. As she looked away less, the frequency of punishment was less, and crying therefore, occurred less. With fewer competing responses, the rate of reinforced vocalizations went up. After session 330 of P, however, optimal behavior rapidly deteriorated except that the punished response, looking away, remained infrequent. Specific punishment (the buzzer) was therefore also infrequent, yet crying increased, percentage of correct imitations decreased, and rate of reinforced vocalizations declined. The baby whined almost continuously throughout these sessions but emitted no loud screams comparable to those during the first P sessions. Although squints and jerks had occurred during the beginning of P upon presentation of punishment, they did not occur again until the last session of punishment and during R/A following P.

As a result of the deterioration in general response topography, the overall effect of punishment on percentage of correct
Six measures of the infant's behaviors during the final 2-1/2 phases of Experiment II. They are: percentage of session time spent looking away, frequency of looking away (per minute), percentage of session spent crying, reinforced vocalizations (per minute), percentage of correct vocalizations, and time between reinforcements (in seconds). Note that graphs one and four are partial reproductions of Figure 2. Again, dotted horizontal lines show means for each phase.
imitations was not favorable. Punishment lowered the percentage of correct vocalizations and, even after punishment was removed, responding did not recover to a proficiency approaching that obtained in the previous R/A phase.

The cause of the general response deterioration and the concomitant whining during the last half of P remained to be explained.

Several explanations have been offered. Perhaps the whining was a function of the number of sessions associated with the aversive stimulus, the buzzer. In that case, however, a gradual rise in crying or whining should have occurred. Also, it would be insufficient with so many variables as those of the sessions run, to explain them as being totally aversive without identifying the components which were aversive. The possibility that every object in the immediate environment of the session was a conditioned aversive stimulus does not seem likely, because the baby continued to come to, and "enjoy" playing with, the investigator and because no similar reactions were observed when she was fed outside of sessions.

Perhaps the whining was operant, in that no time outs conse-
quated the crying as they had in the shaping of the imitative response; i.e., the investigator continued presenting model vocaliza-
zations while eye contact was maintained with the baby, regardless of whether the baby was crying or not. This, however, would again not explain the rather sudden increase in whining that occurred in the middle of punishment.
Another explanation is possible upon analyzing the exact procedure followed during avoidance and punishment. During avoidance, the investigator would wait until eye contact was achieved with the baby and then give a model vocalization for the baby to imitate. After the baby imitated the model correctly, a bite of food was given. A three-second free period was then allowed in which the baby could look away without the buzzer being initiated. If the baby looked away for more than three seconds, the buzzer sounded and she looked back at the investigator, terminating the noise. Eye contact with the investigator served to terminate the noise and served as an SD for the investigator to give a model vocalization for the baby to imitate. The sequence of events during punishment was: (1) eye contact was achieved with the baby, (2) the investigator gave a model vocalization, (3) the baby imitated, (4) reinforcement was given, (5) if the baby looked away from the investigator, the noise occurred and was terminated when she looked back at the investigator, (6) as soon as eye contact was reestablished with the baby, the investigator gave another model vocalization.

As punishment sessions continued, however, the baby looked away less and less, and step 5 in the sequence did not occur. Continuous eye contact by the baby provided a continuous SD for the investigator to present model vocalizations for the baby to imitate.

Perhaps the whining and response deterioration occurred as a result of lack of time between model vocalizations. By correcting the time between reinforcements for crying and looking away time...
and dividing by the number of model vocalizations we get an index of the amount of actual working time the baby had per model vocalization; i.e., a sort of "pressure" index (the sequence time).

Since the baby was receiving frequent buzzer punishment during the initial P sessions (310-323), it is likely that most crying during these sessions was a function of the buzzer. When the buzzer presentations became quite infrequent after session 323, the sequence time might be expected to become significant. During session 331, the sequence number is reduced for the first time. The whining was first observed in session 331. From sessions 323 to 347 there is a strong inverse correlation between percentage of session time spent crying and the sequence times (Rho = -.86). Sequence time during session 347 and during the last reversal could not be comparably calculated because of the large amount of time spent squinting, jerking, et cetera. This time was not precisely measured.

During the E/A procedure, the three-second wait precluded the possibility of model vocalizations being presented too rapidly. During E/A the whining did not occur. It must be remembered that the data supporting the preceding explanation are correlational at best and the negative correlation observed could be an artifact of some other variable.

Perhaps the most plausible explanation is that the whining, bodily contortions, etc., were emotional behaviors indicative of very severe punishment. The response topography during the R and R/A procedures appears quite similar to that of the pidgeons.
receiving punishment consisting of severe electrical shock in Azrin's (1960) study. In addition Ulrich et al. (1969) noted emotional behaviors concomitant with intense punishment in squirrel monkeys.

In evaluating the punishment procedure two questions must be considered. First was the increase in the rate of reinforced vocalizations sufficient to cancel out the decrease in accuracy. Considering that the responses had already been learned; i.e., the baby already knew how to imitate the syllables correctly and should have been making very few errors, any decrease in accuracy could be considered a disadvantage in spite of the increased rate.

Secondly, the fact that the baby's attention lapsed when the punishment was discontinued and her accuracy did not recover to its pre-punishment level indicate that the long term effect of such a procedure may be detrimental.

Thirdly, there is the problem of goals. Can the facts that the baby was almost continually "attentive" and the rate was increased after the punishment took effect outweigh the adjunctive effects of continual whining, frequent squints, jerks and bodily contortions? This question must be left to each person's subjective evaluation.

Upon completion of this experiment it was the conclusion of the author that the use of punishment procedure described for the length of time described is not necessarily beneficial, either for the performance of the imitative task or for the general well-being of the child.
REFERENCES


