AN ANALYSIS OF A PROCEDURE EMPLOYING THE MOWRER IMITATION PARADIGM IN RELATIONSHIP TO THE GENERALIZED IMITATION PROCEDURE FOR ESTABLISHING VOCAL IMITATION

APPROVED:

Major Professor

Minor Professor

Chairman of the Psychology Department

Dean of the Graduate School

Perlman, Wesler H., An Analysis of a Procedure Employing the Mowrer Imitation Paradigm in Relationship to the Generalized Imitation Procedure for Establishing Vocal Imitation. Master of Science (Clinical Psychology), December, 1971, 40 pp., 7 illustrations, bibliography, 29 titles.

Recently, much attention has been given to the autistic child. The diagnostically critical behaviors exhibited by the autistic child can be described as stereotyping, bizarre, self-stimulating behavior, epitomized by severe speech deficits. Although the autistic apparently possesses the structural capacity for language, some fifty per cent are mute (Rimland, 1964).

A highly specialized set of techniques has been devised to establish verbal behavior in mute autistic children. These techniques have been used extensively by Lovaas and his associates (Lovaas, 1966, 1968). In this study, an explicit program of operant conditioning, as mentioned above, was employed. In addition, an attempt was made to provide sessions in which a modified version of the Mowrer imitation paradigm was in effect. The theoretical imitation model advanced by Mowrer accounts for speech development within a learning theory framework. It is consistent with reinforcement theory and with the data obtained by Irwin and Chen (1945, 1946) and Osgood (1953) on speech development. Unlike most accounts of speech development, Mowrer's formulation offers observable variables which can be studied experimentally.

The purpose of this study was to examine the efficacy of an ancillary procedure, the Mowrer imitation paradigm, in conjunction with an ongoing generalized imitation program. It was hypothesized that the ancillary program would accelerate the acquisition of vocal imitation relative to a situation in which the generalized imitation procedure was employed alone.

The subject was a six-year-old autistic girl. It was reported that she never went through a babbling stage and has been mute for the last six years. The procedure involved many discrete phases in what was a complicated program. For organizational and elucidative purposes, the procedure was reported in phases and in the temporal sequence in which they were enacted. Phases I, II, III, and IV were concerned with the establishment of eye contact, motor imitation, a non-discriminated rate of vocalizations, and a discriminated rate of vocalizations, respectively. Phase V-A was a vocal imitation program employing the generalized imitation procedure. Phase V-B was an automated program employing the Mowrer imitation paradigm. Phase VI was a continuation of the procedure of Phase V-A. This phase served to assess the effects of Phase V-B.

The data revealed that the automated program of Phase V-B did indeed have an affect on the speed of acquiring vocal imitative responses. The automated program proved to be a fine auxiliary program for the generalized imitation procedure. The data support the theory of imitation proposed by Mowrer. Along with the theoretical aspects of these results, this study has practical advantages for modification of behavior in the clinical setting. It helps to eliminate experimenter variability and requires less trained personnel. Since new corrective techniques could be generated, it would appear that this area of study merits further investigation.

AN ANALYSIS OF A PROCEDURE EMPLOYING THE MOWRER IMITATION PARADIGM IN RELATIONSHIP TO THE GENERALIZED IMITATION PROCEDURE FOR ESTABLISHING VOCAL IMITATION

THESIS

Presented to the Graduate Council of the
North Texas State University in Partial
Fulfillment of the Requirements

For the Degree of

MASTER OF SCIENCE

By

Wesler H. Perlman, B.S. Ed.
Denton, Texas

December, 1971

LIST OF ILLUSTRATIONS

AN ANALYSIS OF A PROCEDURE EMPLOYING THE MOWRER IMITATION PARADIGM IN RELATIONSHIP TO THE GENERALIZED IMITATION PROCEDURE FOR ESTABLISHING VOCAL IMITATION

Regardless of what we produce in our vast technology, by far our most important and precious commodity is our children. It is our concern and misery that for various reasons, both genetic and environmental, some of them are handicapped. Recently, much attention has been given to the autistic child. The diagnostically critical behaviors exhibited by the autistic child can be described as stereotyping, bizarre, self-stimulating behavior, epitomized by severe speech deficits. Although the autistic apparently possesses the structural capacity for language, some fifty per cent are mute (Rimland, 1964).

Many different causes of autism have been proposed. Faulty parent-child relations (Bettelheim, 1950), biological mutations (Kanner, 1943), and biochemical disturbances (Rimland, 1964) have been offered as answers to the puzzling problem of autism.

In general, these propositions have been presented in a very consistent and logical manner, but it seems that the reasons given bear no real relationship to the present situation. They do not tell us what we can change in either the internal or external environment of the child to bring about new behaviors. Thus far, there are no data to support any of these notions, except the possibility of a biochemical basis. Vitamin therapy seems to point in that direction, although it is not clear as to the specific effects of the treatment (Rimland, 1968). This technique has its merits in the sense of directly manipulating the internal economy of the organism to bring about change.

It does not necessarily follow that the biochemistry is the "cause" of the behavior; moreover, it seems to be a concurrent aspect of the behavior. It is true that the biochemistry of a soldier in battle is quite different from when he is at home. But does it follow that his biochemistry "causes" him to fight? His biochemistry may help him through the battle, but certainly does not cause him to fight. The conditions in the environment affect the behaving organism internally and externally. Changing the internal components should be complemented with environmental changes. We will not further concern ourselves here with the etiology of autism, as there is probably no single cause, but rather multiple causal agents in operation. What these agents are, and what their interactions are, are things on which we can only speculate. (This study is concerned with causes insofar as readily accessible events can be specified and manipulated and are found to be functionally related to particular behaviors). It will be the general purpose of this paper to discuss one approach to the structuring of the environment in a way that will bring about a desired change in the speech of the autistic.

Before methodology is discussed, it will be necessary to review the problem and scan the literature. The basic assumption made is that speech is learned and depends on a "capacity", which is a structural quality. If a man is to hit a ball with a bat, he must have access to an arm and a hand. Also, for a man to talk, he must have lips, tongue and vocal chords not only present, but functional in terms of movement.

Harry Stack Sullivan (Sullivan, 1965) spoke of speech as man's true magic. A child experiences this magical event when his sounds produce objects which he could not acquire in any other fashion. The emission of "milk" by a child is implicitely saying, "Bring me some milk," or "I want some milk," and so on. Verbal behavior allows the speaker to perform operations in the world without really performing them; i.e., the words are discriminative stimuli for the presentation of milk. This cry for milk can bring about one of two results: 1) A change in the environment directly correlated with milk will come about as a result of a mediator intervening, thus producing the change; 2) No one will intervene and no change will come about as a result of the emission of "milk". Thus, performing operations in the world with verbal behavior is dependent on a mediating force.

A child can say "milk" forever, and if there is no mediator, no change in the environment will follow. Of course, he himself could perform the appropriate movements to acquire the milk, but this would depreciate and delete the chief characteristic and advantage of verbal behavior; i.e., that a speaker can produce a change in the environment without performing the act himself. Of course, he could say milk covertly, thereby producing an S^d for himself to perform the act. If he carries it out, then he is able to be the speaker and mediator; i.e., he is able to see himself see himself and hear himself hear himself, which is defined as awareness or consciousness by Skinner.

Since this paper is only concerned with the phenomenon of consciousness peripherily, it will not be discussed further. It may be noted that Skinner's formulation of verbal behavior can be considered as an epoch in the analysis of behavior. His descriptions and explanations of how verbal behavior is conditioned and maintained is quite simple, yet accounts for the most highly complex forms of behavior found in man.

To Skinner, verbal behavior is conditioned and maintained by the verbal community. However, a vast majority of language development is not verbal behavior, so he casually maintains that language development depends on a verbal community. There is ample evidence to support this notion. It seems as though the provenance of language was impalpable for Skinner. The development of language is not a thing, but rather a multifarious process. There are many finite components of language development that deserve a finer analysis both conceptually and experimentally than the analysis set forth by Skinner.

Speech is perplexing for the scientist who attempts to study it, because of its extremely explosive nature. It is very difficult to scrutinize all the events that take place in language development because of the rapid rate at which the child acquires words. This characteristic geometric progression lends itself to metaphysical explanations, which have undoubtedly led us astray.

The assumption that speech is learned leaves us far from the explanation of its development. Two pieces of experimental evidence are pivotal in broadening our perspective. First, Osgood and his associates (Osgood, 1953), have shown that infants employ all sounds of all spoken language when they enter the babbling stage. Casual observation reveals that these multifarious sounds very quickly become modified in predictable ways. Sounds which do not occur in the language of the parents occur less frequently and soon disappear completely from the infant's babbling repertoire. At the same time, sounds which are integral to the parents' language occur with greater frequency and intensity until approximation of words occurs. Irwin and Chen (1945, 1946) did excellent pioneer work in this area. They made phonetic transcriptions of the vocal patterns of tiny infants at each month level. For each age group they counted the frequency of each phoneme in the English language. Irwin and Chen found that from six months until thirty months, the older the child became, the more closely he approximated the over-all frequency of each of these sounds in the parental language.

There is a strong inclination to adhere to a strict re-inforcement theory analysis when these data are considered. As strong social reinforcers, significant others, and especially parents, offer great amounts of attention when babbling first occurs, thus reinforcing babbling and increasing its rate. Parents are impressed by sounds that resemble words in their language; therefore, they soon offer differential attention and approval for babbled sounds which occur in their language, and, relatively speaking, neglect to reinforce foreign sounds. The occurrence of baby's first word is a signal event in any household. The child receives lavish attention for this productive achievement. Some researchers have attempted to push this analysis still further. In doing so, they must place the parent as a constantly present mediator who guides the child across difficult vocal topographies by selectively attending to closer and closer approximations to the parent language.

Empirically, this explanation does not coincide with the interpersonal environment which exists for most infants.

The child does not learn the language word by word under the reinforcing vigilance of his parents. Observation reveals that in normal language development, few words are learned by the direct and contingent intervention of the parents as reinforcing agents. For the most part, it appears that the child teaches himself to talk when parents are not present or not paying attention to his vocal productions.

The observation that children generally are their own speech instructors has led to the conclusion by Chomsky and others (Chomsky, 1966), that speech occurs as a function of innate biological propensities. Unfortunately, these propensities, their nature and description, are not dealt with. Nor can any explanation be offered in mute cases, except to say that the propensity is missing and the organism is aberrant.

A vocal imitation model first proposed by Mowrer may be applicable in a more comprehensive and scientific explanation of normal speech development. Mowrer's (1950) work with teaching birds to talk offers some experimental support for his theory. In relating his findings to humans, he states: "But one must still keep in mind the fact that a bird talks because and only because such behavior is in one way or another rewarding. Initially it is rewarding to the bird to make and to hear sounds which it has heard the trainer make in pleasant contexts. At this first level of performance, words may be said by the bird without much reference to the effects they produce. In this respect they may be compared to the 'babbling' or vocal play of human infants (p. 693)."

In Mowrer's formulation, the infant receives nourishment, comfort, and other primary reinforcing agents from his parents. While receiving these primaries he is exposed to the sounds that the parents typically make as they interact with their child. These sounds become conditioned as secondary reinforcers through repeated paired association with the parent and his primary reinforcers. At a later time when babbling occurs, sounds which the child makes that approximate those typically heard in the presence of his parents, will be reinforced by hearing these sounds. In effect, the infant produces behaviors which are self-reinforcing.

By applying the Mowrer model, a new formulation which has many scientific advantages and appears more comprehensive can be advanced. It is suggested that babbling first occurs as an unconditioned phenomenon, but soon increases in intensity and rate as parents offer direct social reinforcement. At this point, a self-shaping function takes place and the Mowrer model becomes important. At this time, individual utterances may occasionally be directly reinforced by parents, but it is the acquired self-reinforcing quality of sounds which account for the majority of subsequent speech development.

In teaching vocal behavior to mute autistic children, the observance of normal trends of speech development has been generally disregarded. If the conditions which produce speech skills in normal children were satisfactory, then the autistic child would not be mute. Since he is mute, it is obvious that normal conditions which exist in the home have failed. Consequently, a highly specialized set of techniques has been devised to establish verbal behavior in mute autistic children. These techniques have been used extensively by Lovaas and his associates (Lovaas, 1966, 1968). They involve direct contingent reinforcement of appropriate vocalization. Intensive and consistent one-to-one interaction between the child and experimenter is required. It is obvious that the explicit manner in which vocal units are taught is far from recapitulating the conditions which occur in normal speech development. The efficacy of this approach cannot be disputed. Thus far, the data overwhelmingly support it as the single most potent measure employed in the speech training of autistic populations.

In this study, an explicit program of operant conditioning, as mentioned above, was employed. In addition, an attempt was made to provide sessions in which a modified version of the Mowrer imitation paradigm was in effect. It differs from Lovaas' technique in that responses to the vocal prompt need not approximate the prompt in order to be reinforced. The topographies of responses are not directly reinforced. Reinforcement is paired with the sound, thus making the sound a conditioned reinforcer. Reinforcement is contingent upon any vocal response, providing it follows the vocal prompt in close temporal contiguity. What is being reinforced is the discriminated rate of any vocalization.

The purpose of this study was to examine the efficacy of an ancillary procedure, the Mowrer imitation paradigm, in conjunction with an ongoing generalized imitation program. It was hypothesized that the ancillary program would accelerate the acquisition of vocal imitation relative to a situation in which the generalized imitation procedure was employed alone.

Method

Subject

The subject was a six-year-old autistic girl. The parents reported that normal development had been retarded since birth. She had previously been diagnosed as deaf, and consequently wore hearing aids for two years without any apparent results. It was reported that she never went through a babbling stage and has been mute for the last six years.

Apparatus

Many components of electronic and non-electronic apparatus were employed in the study.

During the non-instrumented phases (Phases I, II, III, IV, V-A, VI), a metronome, a stopwatch, a clock, manual counters, and a variety of food reinforcers served as the apparatus.

During Phase V-B, the programmed equipment consisted of a voice key, an M & M dispenser, a fluid dispenser, a two-way microphone, two tape recorders, a probability randomizer, and an auxiliary amplifier.

Procedure

The procedure involved many discrete phases in what was a complicated program. For organization and elucidative purposes, the procedure will be reported in phases and in the temporal sequence in which they were enacted.

Phase I (function)— During this phase, eye contact was established. The subject's deficits were not restricted to verbal behavior. In the beginning, it appeared that she did almost anything to avoid eye contact. The function of this program was to establish stimulus control, and, more importantly, it was a prerequisite for motor imitation, which was to be the next phase of the study.

Phase I (procedure)— The subject was placed on moderate food deprivation and eye contact was reinforced with small morsels of food. The experimenter issued the prompt, "Look at me, Dawn", at twenty-second intervals, and if eye contact was established for three seconds, a reinforcement was delivered. After five weeks of a two-hour-a-day, five-day-a-week regime, eye contact was occurring with consistency. A metronome was set at twenty seconds to provide the discriminative stimulus for the experimenter to give the prompt.

Phase II (function)— During this phase, motor imitation was established. A generalized imitation procedure such as that developed by Baer (1967) and his former students, was selected to generate motor imitation.

This procedure has become the standard one to develop imitation in non-echolalic or non-imitative children, and is becoming widely used with autistic children. At this point, the program was extended to three hours a day, seven days a week, and continued in this manner for five months. The function of this phase was to ensure stimulus control, and it also served to facilitate vocal imitation.

Phase II (procedure)— The experimenter would say, "Look at me, Dawn". If eye contact was established, the experimenter introduced a prompt by saying, "Do this", and giving the motor prompt of raising his arm, thus serving as a model to be imitated. If the response was imitated, food reinforcement quickly followed. The prompts were issued at fifteen-second intervals. Baseline was taken on four motor responses which were found to be given at zero per cent.

(Since none of these responses were in her repetoire, the procedure entailed elaborate shaping and fading techniques. With the first motor response chosen, the arm raise, the experimenter issued the prompt and at the same time raised the subject's arm with his free hand, providing an extra stimulus cue to be later faded out systematically). Initially, it was necessary to guide her arm all the way up until it assumed the defined appropriate position. Contact with her arm was systematically lessened and finally eliminated altogether. After stimulus control was reliably enstated, three other motor prompts were introduced and in a similar fashion the subject was taught to imitate them.

Phase III (function)— This phase of the study was concerned with vocal behavior. The experimenter, through the course of three months, had observed only a single utterance. The function of this phase was to establish a free operant, non-discriminated rate of vocalization. This was a necessity, since this study was to assess a new type of verbal training program in relationship to a well established method for establishing vocal imitation. During this phase, phase II was continued and maintained concomitantly.

Phase III (procedure)— Work began by touching the mouth, lips, and pulling the tongue. This was the first attempt to elicit sounds, but none occurred. Next, the diaphragm was pushed, forcing air through the esophagus and producing what could be called the subject's first sounds. Though this was effective, the physical prompts of pushing against the diaphragm could not be faded out. A hissing sound was directed to her ear. This appeared to be aversive, for she grimaced and made a screeching sound. Immediately, the screech was reinforced. This was effective, but it quickly resulted in tantrums. Since the ear seemed to be a focal point, the experimenter placed his hands on the sides of her face, covering the ears, and extended the thumbs so that they were on the subject's throat. The hands and thumbs moved concurrently and produced sounds with no accompaniment of tantrums. The tactile stimulation was faded out, and, as sounds were reinforced, their rate of occurrence steadily increased. This so-called procedure entailed both negative and positive reinforcement, for when the sound was emitted, the hands of the experimenter were removed and a food reinforcer quickly followed. At this point she was going through a babbling stage which resembled that of a young infant.

Phase IV (function)— During this phase, a discriminated rate of vocalization was established. It was necessary that sound productions become discriminated when vocal prompts were given by the experimenter so that the subject could come to operate on the automated apparatus employing the Mowrer model of imitation. This would also prime her for a generalized imitation method. Both of these forthcoming phases were dependent upon the subject's responding to a vocal prompt. Perhaps a discriminated rate of vocalization could have been acquired without a free, operant, non-discriminated rate coming first, but this did not seem desirable.

From a logical viewpoint, it seemed that Phase III, which was employed, would yield a wider variation of sounds and also increase generalizability outside of the experimental confines.

Phase IV (procedure)— The experimenter issued the prompt, "Do this, Dawn", and if the subject produced any vocalization, it was reinforced with food or liquid. The discriminative stimuli used to establish the free operant rate of vocalizations in Phase III were reintroduced to help generate a discriminated rate of vocalizations. These discriminative stimuli accompanied the experimenter's vocal prompt, because they were consistent in helping to emit sounds, and also provided a desirable fading dimension. The experimenter issued the prompts at twenty-second intervals.

Phase V— At this time, the verbal training program was separated into two distinctly different procedures, each of which occurred daily.

V-A (function)— This program followed the generalized imitation procedure. As the subject mastered the imitation of one new sound, new sounds would be introduced, and her sound repetoire would be increased. Eventually, sounds would be combined into words and prompts would be faded until the subject could label objects when they were presented. These steps have been quite adequately demonstrated and documented by Lovaas (Lovaas, 1966, 1968).

V-A (procedure)— This program was a continuation of the generalized imitation method. Just as motor prompts had been previously introduced to establish motor imitation, now specific vocal prompts or sounds were introduced. Just as shaping and fading techniques were used in facilitating motor imitation, now they were used in a similar fashion to generate vocal imitation.

V-B (function)— This program was based on the imitation model proposed by Mowrer, as discussed in the introduction. It included a considerable amount of apparatus, which would allow the program to continue without the need for an experimenter's presence. Sounds presented as prompts were paired with reinforcement, thus making the sound a conditioned reinforcer. These pairings would increase the probabilities that the subject would imitate the sounds, because it was hypothesized that the subject-produced sounds which resembled the prompts should be reinforcing to her when she hears them.

V-B (procedure)— Just as the discriminated babbling program (Phase IV) was expanded to be a generalized imitation procedure (Phase V-A), it was modified to become an automated program. The experimenter was faded out of the experimental room and, concomitantly, headphones and microphone were faded in. In the intervening time, the subject was magazine trained to both M & M and fluid dispensers. During this time the delivery of reinforcement was facilitated by a handswitch.

The subject was now alone in an experimental room, wearing earphones and a microphone around her neck. When the experimenter was faded out of the room, a tape recorder served to issue the prompt. One tape recorder presented her with vocal prompts every thirty seconds. Three different sounds were presented in a randomized order. The prompts were: "Do this: $\bar{A}$, $\bar{A}$, $\bar{A}$". "Do this: huh, huh, huh". "Do this: mm, mm, mm". If a sound was produced following the prompt, either the M & M dispenser or the fluid dispenser was operated on a low ratio reinforcement schedule. In this manner the subject was reinforced for producing a sound after being prompted by the tape. Another tape recorder recorded both prompts and responses. Each data day consisted of 100 trials - i.e., 100 presentations of the prompt.

During this part of the program it was not necessary that the vocal response following the prompt resemble the prompt in the least. Any sound produced after the prompt was a "correct" response, provided that it was of sufficient intensity to operate the voice key relay and that it occurred within five seconds after the prompt. Thus, approximations were not differentially reinforced. (What was being reinforced was the rate of occurrences in which any prompt was followed by any vocal response).

Phase VI (function)— This phase was a continuation of Phase V-A. This phase served to assess Phase V-B.

Phase VI (procedure)- During the tenth day of the automated program, six sounds, three of which were the programmed sounds, were introduced in the generalized imitation regime. Each sound had a block of fifty trials during each data day. The presentation order of the blocks of trials was also randomly assigned. At the outset of the programmed procedure, base rates had been taken on the six sounds. They were found to be at zero percent.

Results

Figures 1 and 2 present the data for Phase II. The percent of correct responses is presented on the ordinate of the graph and data days are shown on the abscissa. A vertical line on both Figures indicates those data days on which prompting procedures were utilized. During the section labelled "physical prompts", ancillary prompting with fading procedures were in effect. During the section labelled "no physical prompts", no ancillary prompts were used. Figure 1 of the appendix displays the data for the first motor response, the arm raise. Figure 2 is a composite of the four motor responses taught using motor imitation procedures. The four responses are presented in the order in which they were taught - arm raise, hand clap, nose touch, and head touch.

The data for Phase III are presented in Figure 3. During this phase, the free operant rate of vocalizations was reinforced. Initially, prompting procedures were employed to elicit vocal responses, but these data are not included in the figure. The frequency of vocalizations is presented on the ordinate and forty-minute daily sessions are presented on the abscissa.

Figure 4 of the appendix displays the frequency of discriminated vocal productions. During this phase (Phase IV), only those sounds which immediately followed the prompt, "Do this, Dawn", were reinforced. In the initial part of this phase, additional physical prompts were used to facilitate training. The vertical line on the graph separates the period where prompting and fading procedures were and were not utilized. The period of time during which fading procedures were in effect is labeled "verbal assist". The other period of time in which these procedures were not present is labeled "no verbal assist". The percentage of vocalizations in response to the number of vocal prompts presented is displayed on the ordinate, data days on the abscissa.

Figure 5 of the appendix includes the data representing the percentage of vocalizations progressing from Phase IV to Phase V-B. Phase IV involved discriminated vocalizations and Phase V-B involved discriminated vocalizations on the automated procedure. Vertical lines on the graph separate the various procedural changes. The first section presents the percentage of vocalizations during discrimination training. The second section presents the percentage of vocalizations when verbal assists were faded out. Also, the various apparatus were faded in, and, concomitantly, experimenters were faded out. The third section presents the percentage of vocalizations during the initial sessions when the subject was alone with the recording apparatus. The percent of discriminated vocalization is presented on the abscissa and data days on the ordinate.

Figure 6 presents all the data on the percentage of the tape recorded sounds. This is the terminal stage of Phase V-B. The percent of discriminated vocalizations is presented on the abscissa and data days on the ordinate of the graph.

Figure 7 of the appendix presents the data for Phase VI. The percent of correct responses is found on the ordinate of the graph and data days on the abscissa. Two graphs are presented in Figure 7. The upper graph presents the programmed sounds, while the lower graph depicts the non-programmed sounds. A code for the sounds appears at the right hand side of the figure.

Discussion

During Phase II, the acquisition of the first motor imitation, the arm raise, took three and one-half weeks. The physical prompts were faded completely after eleven days. Figure 1 of the appendix shows a sudden decrement in responses after prompts were faded out. This decrement occurred with all motor imitations when the prompts were completely deleted, but each response steadily increased in rate until it reached the criterion of 100 per cent. Also, it should be noted that this characteristic decrement became less as each new response was conditioned. Figure 2 of the appendix shows that each motor response reached the criterion of 100 per cent more quickly than the preceding one. This indicates a learning set phenomenon as suggested by Harlow (1965), or in the operant nomenclature, the beginnings of generalized imitation (Baer, 1967). This is also reflected by the fact that the physical prompts were faded out more quickly with each new motor imitation.

During Phase III, three weeks were spent trying to elicit sounds before an effective technique was reached. The rate of vocalizations steadily increased and remained relatively constant, although variability was indeed present. It was constant in the sense of assuming the same range of values over a long temporal sequence. Continuous reinforcement was gradually changed to a low variable ratio schedule of reinforcement. As reinforcement continued, the frequency of sounds increased geometrically on the 21st day, as shown by figure 3 of the appendix. It was reported by the subject's mother that the "babbling" carried over to the home situation and to other areas outside the experimental confines.

The discriminative stimuli used in establishing the free operant rate of vocalizations during Phase III were reintroduced to help generate a discriminated rate of vocalization during Phase IV. These stimuli were consistent in helping to emit sounds and also provided a desirable fading dimension. These factors should be taken into consideration when looking at the data in Figure 4 of the appendix. These data reveal that the percentage of time that the experimentor's vocal prompt was followed by the subject's vocal response was high during the initial days, and remained at that level while the physical prompts were quickly faded out. During the first day of Phase IV, sounds were at a high rate during the entire experimental session. As each new day passed, these sounds that were occurring in the interim between the experimentor's vocal prompts became increasingly lower, until they ceased to occur on the fifth day of the procedure. This observation, along with the increase in appropriate responding following the vocal prompt indicates the establishment of stimulus control, as defined by Whaley and Malott (1970).

Figure 5 of the appendix shows the different procedural changes of reaching the automated procedure of Phase V-B. It should be noted that downward trends in observed percentages took place when headphones, M & M dispenser, and microphones were faded in and the experimentor was faded out. This situation is similar to the decrement of motor response when prompts were faded out during Phase II. In general, the data indicate decrement in probability when experimental conditions change, a well documented phenomenon in psychological research. The data also indicate that when the changes are made gradually, the responses remain in the repetoire under many new conditions. When the terminal stage of Phase V-B was reached, the percentage of responses had diminished appreciably since the beginning stages. This is illustrated by Figure 5 of the appendix. Once the experimental conditions were held relatively constant, Figure 6 shows that the response rate steadily increased until it was once again a reliable occurrence. Gradual changes in experimental conditions allowed for the transition from Phase IV to Phase V-B.

If the procedure employing the Mowrer model (The terminal stage of Phase V-B) was effective in this case, it would be expected that the sounds presented as prompts would develop conditioned reinforcing qualities, since they are paired with reinforcement. Sounds which the subject produced that resembled the prompts should be reinforcing to her when she hears them. Therefore, the more they resemble the preceding prompt, the more self-reinforcing they should be. The subject was approximating the programmed sounds and even occasionally initiating them when the <u>generalized imitation</u> procedure (Phase VI) for evaluating the programmed sounds was introduced. A possible constraint, in terms of the subject imitating the sounds reliably without any other training, was the lack of variation in different kinds of sounds. The possibility of a locked rate (Sidman, 1960) on one or two sounds could occur. The probability of this happening was increased by the fact that the subject's repertoire of sounds was limited in terms of different kinds of sounds. This, along with no visual mode of stimulation on the programmed sounds, led to the selection of the generalized imitation procedure to evaluate the affects of the programmed procedure.

The six sounds that were selected for evaluation were all in the same range of difficulty, in terms of positioning and movement of the vocal apparatus. The data reveal that the automated program did indeed have an effect on the speed of acquiring vocal imitative responses. Figure 7 of the appendix shows that the programmed sounds had an initial small rise in probability during the fourth day of the procedure. At the fifth and sixth days, the programmed sounds showed a dramatic increase in probability, as compared to the non-programmed sounds. The programmed procedure proved to be a fine auxiliary program for the generalized imitation procedure. The data support the theory of imitation proposed by Mowrer.

Along with the theoretical aspects of these results, this study has practical advantages for the modification of behavior in the clinical setting. The modification program is unique, in that it is an implicit program, versus the typical explicit program.

There is a distinction to be made between explicit and implicit programming. Explicit programming tries to control all relevant variables and arranges reinforcement to be contingent on the terminal behavior, or approximations thereof. Implicit programming arranges the contingencies so that reinforcement is not contingent upon the terminal behavior or approximation of it, but rather reinforces a behavior in the response class, so as to increase the probabilities of the terminal behaviors. Approximations may be reinforced along the way, but it is not a prerequisite for reinforcement.

The rate of responding is reinforced, and no "quality" control is exerted. In a general way, the response in an implicit program is in the same response class of the terminal behavior, or it is part of a link in a chain. In Phase V-B of this study, the vocalization that is reinforced is in the general response class of vocalizations but, in a more specific way, it is not in the response class of the particular sound, the terminal behavior. This differs from Phase V-A and VI because of the explicit manner in which vocalizations were reinforced. Reinforcement was contingent upon approximations which were in the response class of a particular sound, the terminal.

In clinical practice, implicit programs prove to be valuable, because contingencies already existing in the environment can be utilized. With a problem drinker, it is often hard to follow the subject around all day and punish the terminal response. The chain can be broken down by reinforcing him to go to "Alcoholics Anonymous", and also by reinforcing him for reading literature on the topic. The terminal behavior is not directly worked on. Old chains are broken up and new chains are built. If one is preoccupied with breaking a chain up, the new chain may be neglected and lead to the old behavior. It is wise to make the new chain incompatible with the old chain.

Another example of an implicit program could be a failing college student. Since the terminal behavior can not be directly reinforced, both attendance behavior and two hours of library time would be reinforced. This would increase the probability of the desired terminal behavior.

A case is presented in which the desired response is "C". Approximations (C_1, C_2, and C_3) can be explicitly reinforced to obtain "C". If the response "C" is unwanted, the behavior can be explicitly punished. If an implicit program is selected, responses "A" and "B" would be reinforced to obtain desired response "C". If the response is unwanted and an implicit program is selected, responses "A" and "B" would be punished to obtain the decrement of response "C". Also, responses "D" and "E" could be reinforced, which would be incompatible with response "C".

There are obvious advantages and disadvantages of both types of programming. Explicit programming almost insures the desired results, but quickly exhausts resources in terms of apparatus and personnel. Implicit programming increases the probability that it will happen, but not with the level of confidence of an explicit program. The implicit program relies on existing contingencies, or on an existing technology of instruments from which the contingencies can be arranged. Usually, explicit programming relies on new technological advances and also requires complete control, which is often impossible and highly impractical in terms of both experimenter and subject. Implicit programs, when arranged, are explicit in the sense of being designed, but implicit in terms of the effects produced.

The data collected in this study have definite implications for causative explanations of mutism. The data indicate that changes in the environment of the autistic child produce corresponding changes in their behavior. These results question Kanner's hypothesis that autistic behavior is the result of an innate deficit, and likewise challenge Bettelheim's notion that autistic children need love and attention in order to correct their deprived emotional state. Both of these positions implicitly present the autistic child as an aberrant organism whose behavioral system is not comparable in most critical respects to ordinate populations.

The data from this study demonstrate the behavior of the autistic to be comparable in most general respects to non-clinical counterparts.

This does not vitiate the importance of "love" or biochemistry, however.

Love and attention may not be needed at all in the sense of drive state. They can, however, be effective variables for changing behavior, if made contingent on behavior either by their presentation or withdrawal, depending on whether the behavior is wanted or unwanted. No statement on the biochemical hypothesis is warranted except to say that the physiological correlates could not be studied, due to lack of resources. Of all the causative explanations of autism, the biochemical basis is the only one that seems to offer parameters which can be studied experimentally. Even when these variables are studied and possibly found to be related to the phenomenon, it would be unwise to attribute them as causal agents. Rather, it seems that all the data should be integrated in order to generate corrective procedures, and not to single out one aspect as the cause of autism.

The data obtained on the programmed procedure have definite clinical implications. These procedures could easily be installed in the home, as the training would involve decisions made by the apparatus. Before this can be done, however, more research is needed to evaluate the effectiveness of this method. Further research could be fruitful, if conducted with autistic populations and normal infants. For these reasons, it would appear that this area of study merits further investigation.

APPENDIX

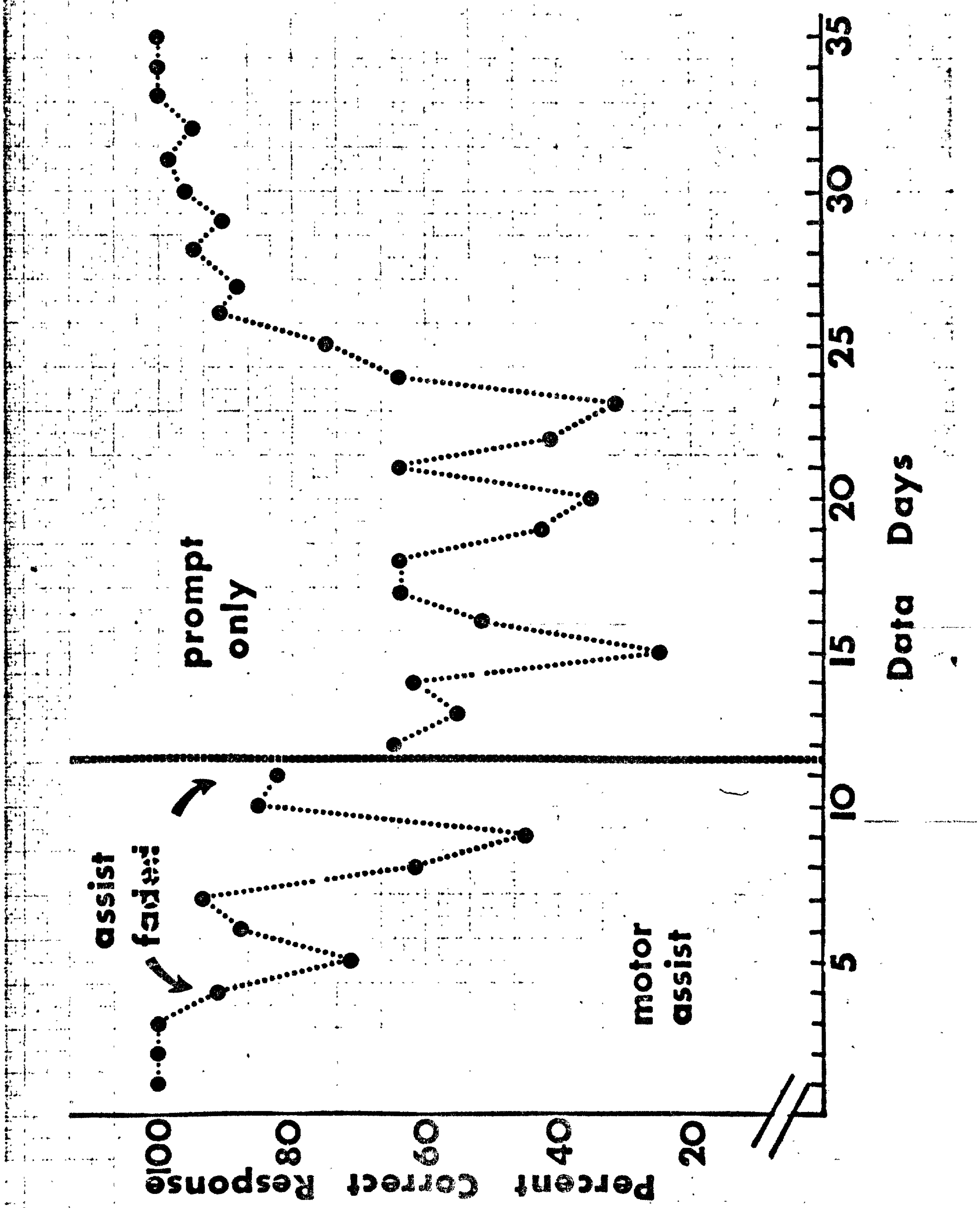

Figure 1--Motor Imitation - The Arm Raise

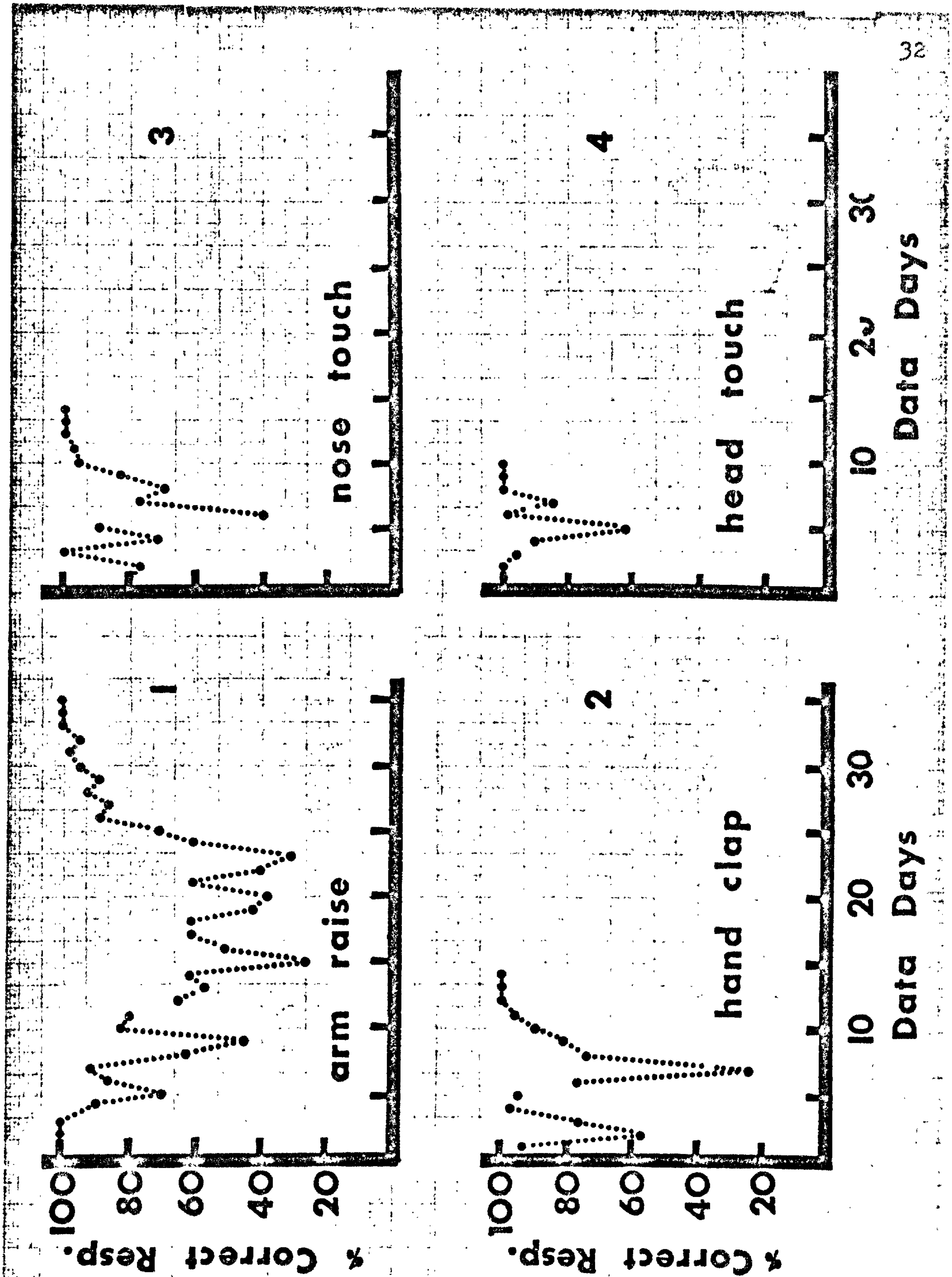

Figure 2--Motor Imitation - Composite of Arm Raise, Hand Clap, Nose Touch, and Head Touch.

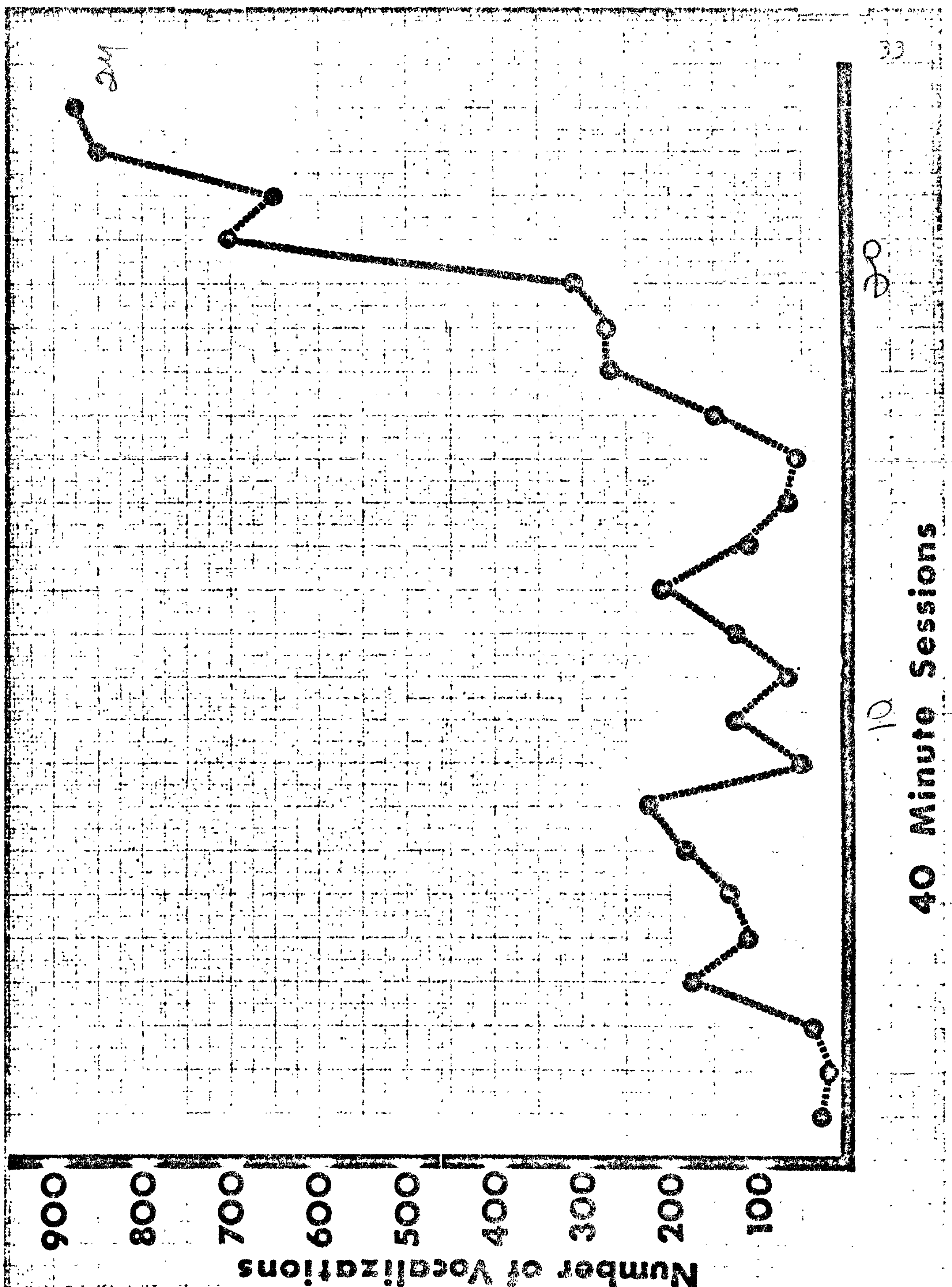

Figure 3--Non-discriminated Rate of Vocalizations.

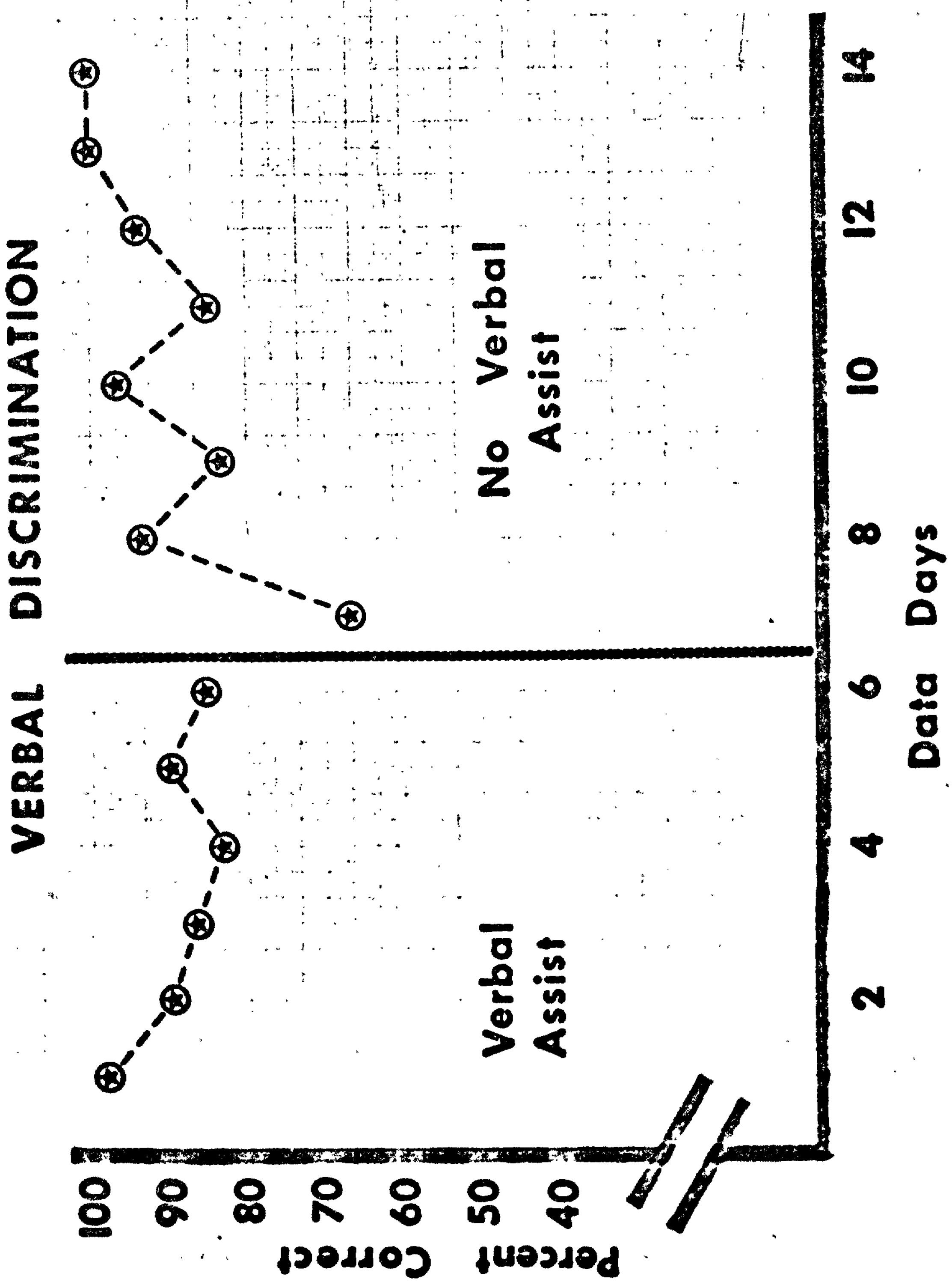

Figure 4--Discriminated Rate of Vocalizations.

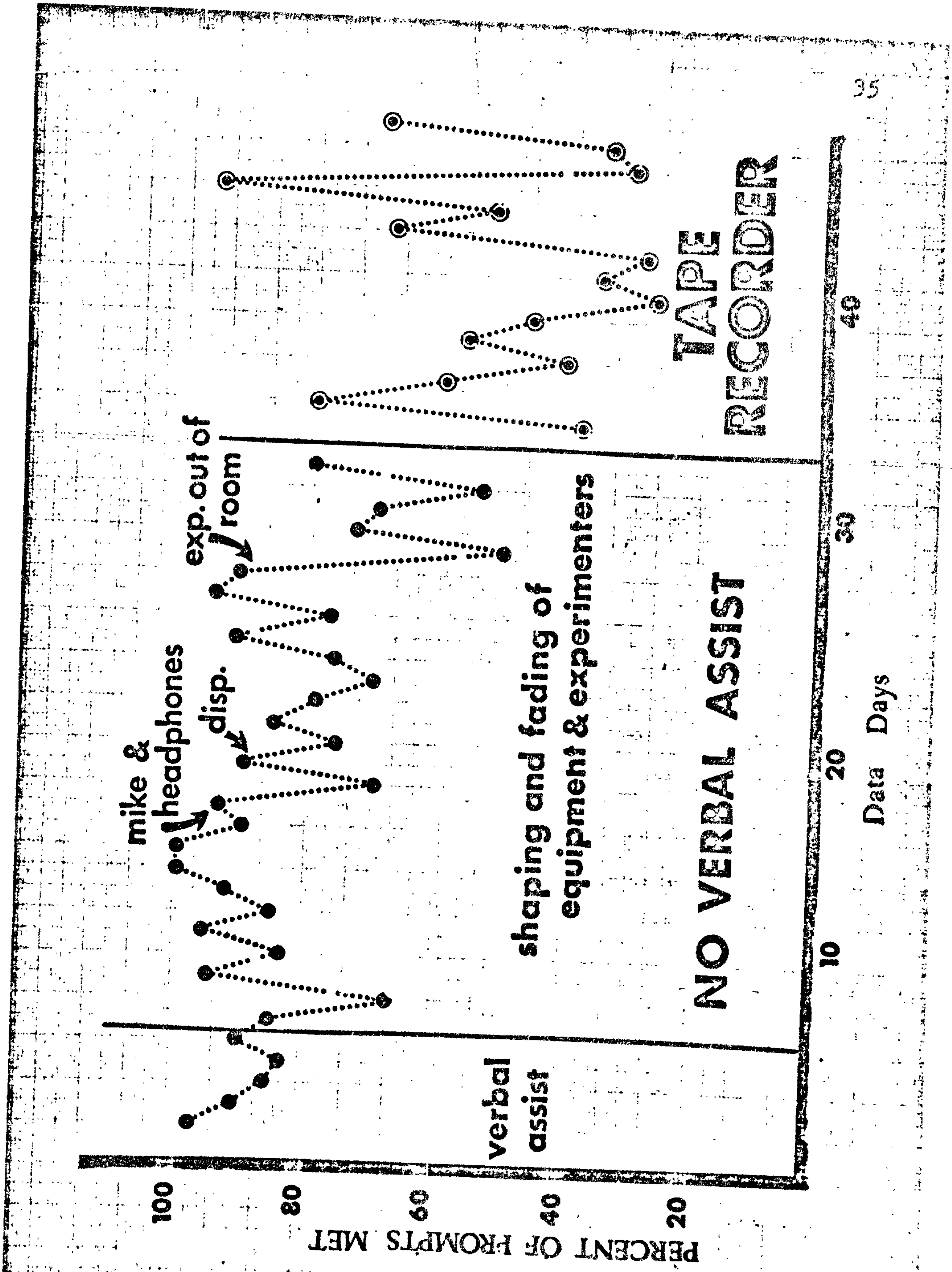

Figure 5--Transition from Phase IV to Phase V-B.

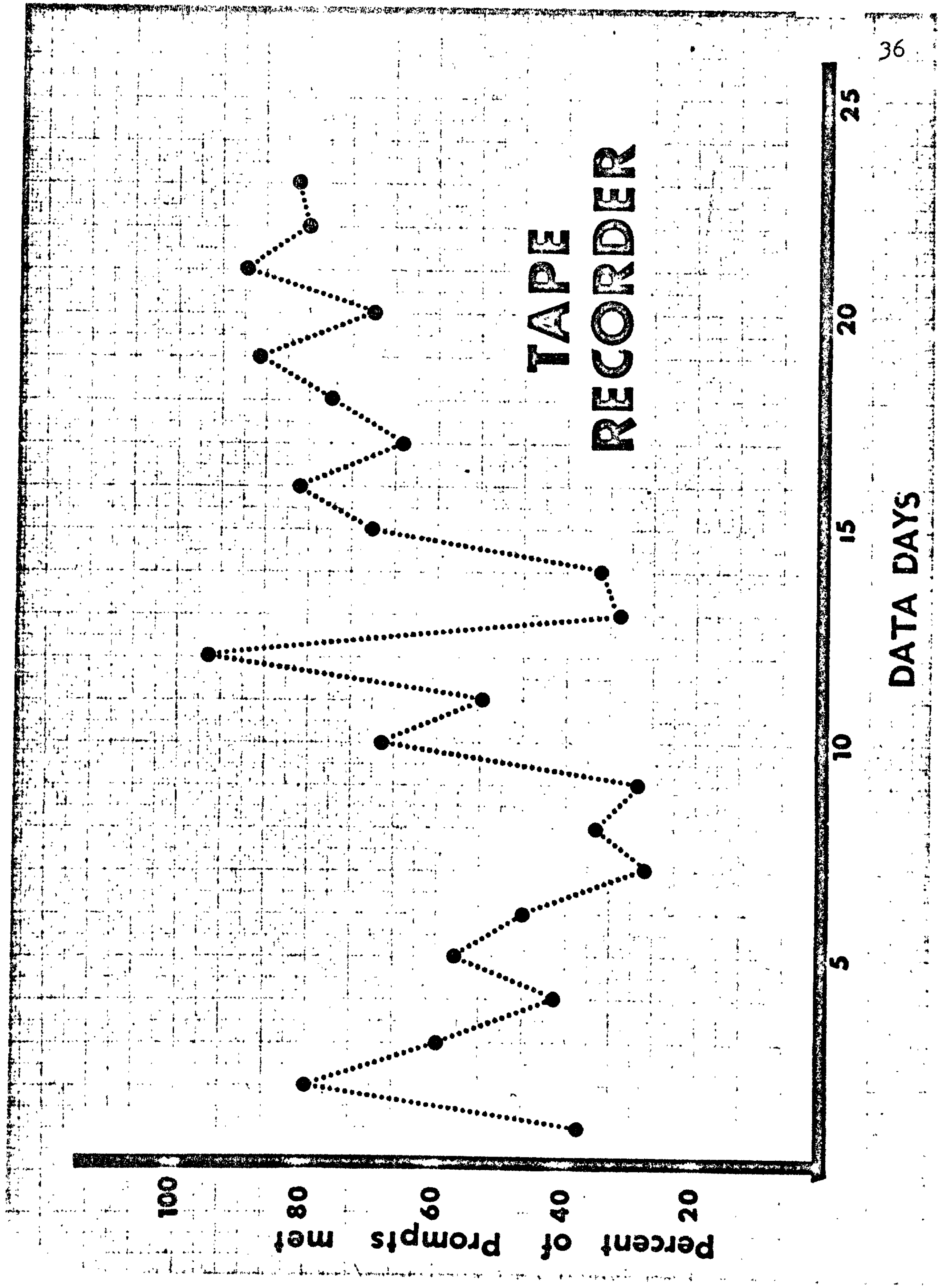

Figure 6--Terminal Stage of Phase V-B

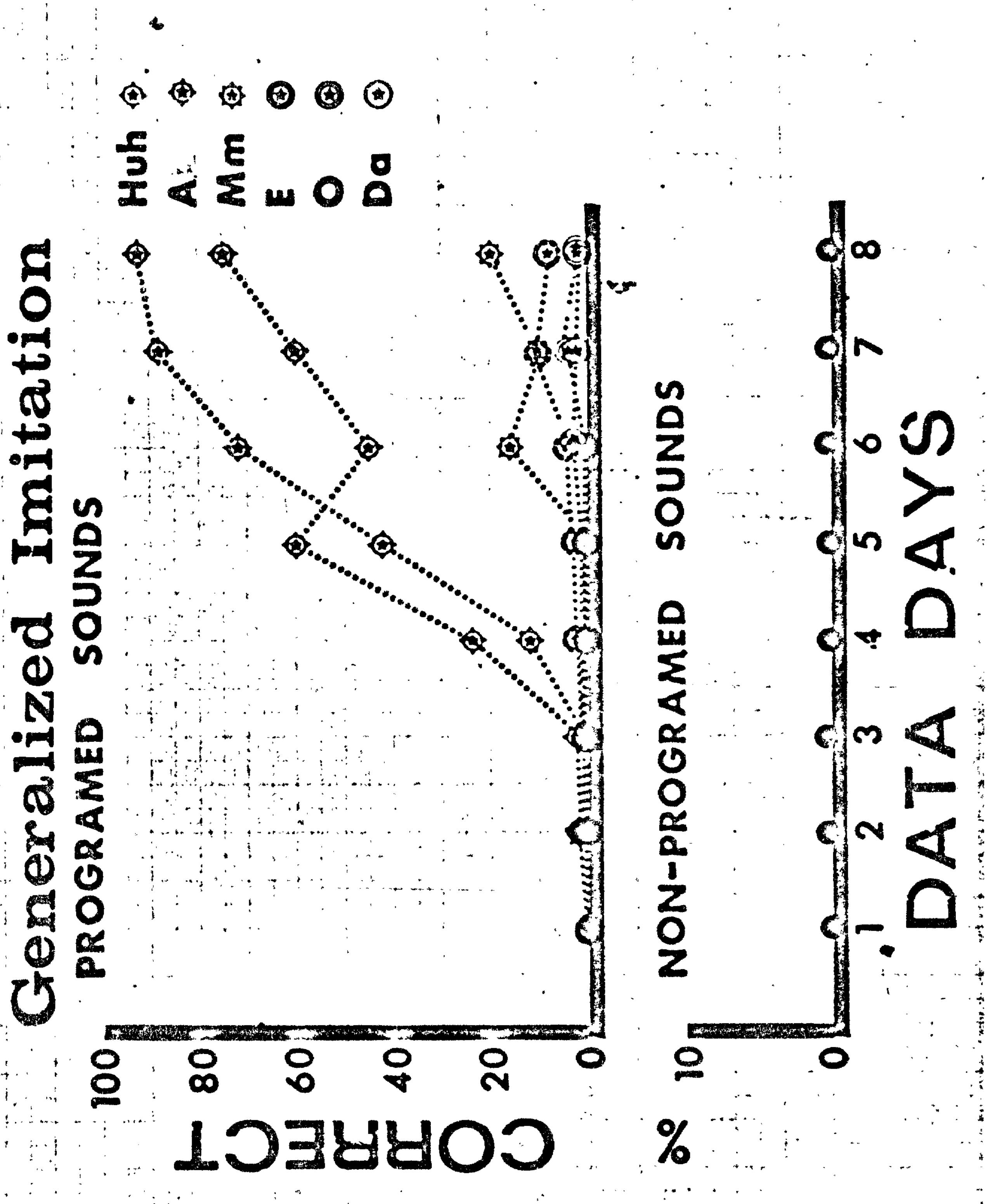

Figure 7--Phase VI --A comparison of the programmed sounds versus the non-programmed sounds.

References

Axline, V. M. Dibs: In search of self. New York: Ballantine Books, 1964.

Baer, D. M., Peterson, R. F., & Sherman, J. A. The development of imitation by reinforcing behavioral similarity to a model. Journal of the Experimental Analysis of Behavior, 1967, 10, 405-416.

Bettelheim, B. Love is not enough. New York: The Free Press, 1950.

Bricker, W. A., & Bricker, D. A. A program of language learning for the severely language handicapped child. Exceptional Children, 1970, 2, 35-42.

Chomsky, N. Linguistic theory. Northeast Conference, 1966.

Ferster, C. B. An operant reinforcement analysis of infantile autism. In S. Lesse (Ed.) An evaluation of the results of psychotherapies. Springfield, Illinois: Charles C. Thomas, 1968.

Harlow, H. F. Behavior of non human primates: Modern research trends. New York: Academic Press, 1965.

Hewett, F. Teaching speech in an autistic child through operant conditioning. American Journal of Orthopsychiatry, 1965, 35, 927-936.

Irwin, O. C. The mastery of vowel and consonant sounds during the period of infancy. American Psychologist, 1947, 2, 314.

Irwin, O. C., & Chen, H. P. Development of speech during infancy, curve of phoneme types. Journal of Experimental Psychology, 1946, 36, 431-436.

Irwin, O. C., & Chen, H. P. Infant speech: Vowel and consonant frequency. Journal of Speech Disorders, 1946, 11, 123-125.

Kanner, L. Autistic disturbances of affective contact. Nervous Child, 1943, 2, 217-250.

Kanner, L. Problems of nosology and psychodynamics of early infantile autism. American Journal of Orthopsychiatry, 1949, 19, 416-426. Cited by B. Rimland, Infantile Autism. New York: Appleton-Century-Crofts, 1964. P. 69.

Lewis, M. M. Infant Speech: A study of the beginnings of language. London: Humanities Press, 1951.

Lovaas, O. I. A program for the establishment of speech in psychotic children. In J. K. Wings (Ed.) Early Childhood Autism. Oxford: Pergamon Press, 1966.

Lovaas, O. I. A program for the establishment of speech in psychotic children. In. H. Sloane and B. MacAulay (Eds.) Operant procedures in remedial speech and language training. Houghton Mifflin, 1968.

Lovaas, O. I. A behavior therapy approach to the treatment of childhood schizophrenia. In the Minnesota Symposium of Child Psychology, 1967.

McCarthy, D. Language development in children. In L. Carmichael (Ed.) A Manual of Child Psychology. New York: Wiley, 1964.

Mowrer, O. H. Learning theory and personality dynamics. New York: Ronald Press, 1950.

Osgood, C. E. Method and theory in experimental psychology. New York: Oxford University Press, 1953.

Reese, H. W., & Lipsitt, L. P. Experimental Child Psychology. New York: Academic Press, 1970.

Rimland, B. Infantile autism. New York: Appleton-Century-Crofts, 1964.

Rimland, B. High dosage levels of certain vitamins in the treatment of children with severe mental disorders. Unpublished manuscript, Institute for Child Behavior Research, San Diego, California, 1968.

Sidman, M. Tactics of Scientific Research. New York: Basic Books, 1960.

Skinner, B. F. Science and Human Behavior. New York: The MacMillan Company, 1953.

Skinner, B. F. Verbal Behavior. New York: Appleton-Century-Crofts, 1957.

Skinner, B. F. Contingencies of reinforcement: A theoretical analysis. New York: Appleton-Century-Crofts, 1969.

Sullivan, H. S. Collected Works. New York: Norton, 1965.

Whaley, D. L., & Malott, R. W. Elementary Principles of Behavior. New York: Appleton-Century-Crofts, 1970.