DOCUMENT RESUME

ED 021 643 PS 001 228

By- Michealis, Mary Lou; Etzel, Barbara C.

HEAD START EVALUATION AND RESEARCH CENTER, UNIVERSITY OF KANSAS. REPORT NO. VIID, A CASE STUDY ILLUSTRATING AN EXPERIMENTAL DESIGN FOR EVALUATING THE EFFECTS OF SHAPING GROSS MOTOR COORDINATION IN A 31 MONTH OLD CHILD.

Kansas Univ., Lawrence. Dept. of Human Development.

Spons Agency- Institute for Educational Development, New York, N.Y.; Office of Economic Opportunity, Washington, D.C.

Pub Date 30 Nov 67

Note- 29p.

EDRS Price MF-$0.25 HC-$1.24

Descriptors- BEHAVIOR CHANGE, BEHAVIOR PATTERNS, CONDITIONED RESPONSE, *EXCEPTIONAL CHILD EDUCATION, *EXCEPTIONAL CHILDREN, *EXCEPTIONAL CHILD RESEARCH, MENTAL RETARDATION, MINIMALLY BRAIN INJURED, *MOTOR DEVELOPMENT, OPERANT CONDITIONING, POSITIVE REINFORCEMENT, TRAINABLE MENTALLY HANDICAPPED, TRAINING TECHNIQUES

A multiple baseline design for modifying the gross motor coordination of a 31-month-old boy suspected of suffering from congenital brain damage was conducted at the University of Kansas Infant Study Laboratory. The primary purpose of the study was to establish, by experimental procedures, the desired, but absent, behavior of walking, getting up, and climbing stairs, at the expense of the existing behavior of scooting, pulling up with support, and not climbing stairs. It was hypothesized that, incidental to establishing the three desired behaviors, the behavior of standing without support would replace the subject's need to stand with support. The training sessions for each of he three desired behaviors were based on the gradual modification of undesirable into desirable behavior through selective reinforcement. The three desired behaviors were initially of zero incidence but were ultimately established as part of the child's response repertoire, although not to the complete displacement of the undesirable behaviors. (WD)

The University of Kansas Head Start Evaluation and Research Center

VII D

"A Case Study Illustrating an Experimental Design for Evaluating the Effects of Shaping Gross Motor Coordination in a 31 Month Old Child"

Mary Lou Michealis B.A.
Barbara C. Etzel Ph. D.

Department of Human Development

A Case Study Illustrating An Experimental Design for Evaluating the Effects of Shaping Gross Motor Coordination [illegible] in a 31-Month Old Child[1]

Mary Lou Michaelis[2] and Barbara C. Etzel

ABSTRACT

Running head: An Experimental design for shaping gross motor responses.

A multiple baseline design was described and utilized in the training of gross motor responses in a young preschool child. The responses of sitting and scooting decreased over time as the responses of walking, getting up without support and climbing steps were shaped and increased in rate. Standing without support was not trained but was observed to increase as a result of the experimental procedures employed.

A CASE STUDY ILLUSTRATING AN EXPERIMENTAL DESIGN FOR EVALUATING THE EFFECTS OF SHAPING GROSS MOTOR COORDINATION IN A 31-MONTH-OLD CHILD[1]

Mary Lou Michaelis[2] and Barbara C. Etzel
The University of Kansas

The fruitfulness of behavior modification procedures as applied to a wide variety of problems has been obvious through the increased literature and interest in the field. Equally striking is the fact that the same principles are used regardless of the problem behavior studied. Bijou and Baer (1967) indicated when the same behavior modification principles are successfully applied that no clear or useful distinction between the areas of, e.g., child therapy or rehabilitation need be made. An experimental analysis approach is perhaps changing the psychologist back to a generalist.

A set of experimental procedures common to many behavior modification studies involve: "baseline" records of operant level of responding; the application of contingent reinforcement to desired behavior (with concurrent extinction of undesired behavior); reversal of procedures (after modification has occurred) so that baseline conditions are reinstated; and finally a return to contingent reinforcement with a thinned schedule being used at the end to ensure "durability" of desired responding.

One of the problems of the above sequence of procedures is that on occasion behavior does not return to its original baseline under reversal conditions. Hence, the experimenter cannot always conclude that the procedures he used to modify the behavior were responsible for the change during the "contingent" condition. Sidman (1960) has written most extensively about the irreversibility problem. If the original independent variables did in fact produce the behavioral change, then the question becomes one of why these variables are now insensitive to manipulation. Sidman has emphasized that irreversibility can and should be accounted for. One approach he suggests is to identify what variables are responsible in those instances in which irreversibility appears.

Baer (1967) attended to the problem of irreversibility that occurred during several studies of social interaction in preschool children. His analysis, which includes a design for studying the irreversible process, also suggests some variables that may be responsible for a later insensitive independent variable, such as the reinforcing aspects of teacher attention to peer interaction. In likening the preschool environment to a mouse trap, Baer suggests that once an entry response has been accomplished (that is, a child has been reinforced for and is interacting with other children), very soon a larger community of mutually reinforcing contingencies will occur between child and peers. Thus to "extract" the child from this now natural environmental "trap" of reinforcing contingencies is almost impossible. Reversal procedures are not effective in returning the child's behavior to the previous baseline rate.

To carry Baer's analogy a bit further, one might say that some behaviors when modified may result in an environment in which only a few additional reinforcing stimuli are produced for a child--that is, the mouse trap has a weak spring. The child can easily slip in and out, hence reversibility can be easily shown in experimental procedures. However, other behaviors when modified may produce further massive environmental consequences beyond those of the specific behavior which was altered. The added reinforcing stimuli are many and perhaps, even more immediate. Here the trap can be likened to a strong-spring bear trap (bear as in infra-human animal, not our esteemed Homo Sapien colleague).

The problem of how easy it is to apply reversal procedures can be conceived of as a function of how much the newly acquired behavior results in altering the child's total environment with respect to amount and immediacy of new reinforcing stimuli available to him. Also a setting event, such as amount of deprivation, may be a factor.

Studies dealing with altering self-destructive behavior in retarded or autistic children have successfully used reversal procedures (Lovaas, et al., 1965). Wolf, et al. (1964), demonstrated that glasses-throwing was easily reversed and Harris, et al., (1964), reversed regressed crawling. Each of these studies in the area of child therapy no doubt were successful in using reversal procedures because the reversals were initiated early, before other aspects of the environment became reinforcing over and beyond the reinforcement provided specifically to modify the behavior. Baer stresses the time of instituting reversal procedures as critical in social interaction studies.

It is probably quite true that reversal procedures are difficult to implement in some studies of social interaction, especially if not applied soon after the desired response has become consistently observable. It would appear, however, that reversal may be impossible or difficult to implement in some areas of gross motor behavior. In a study in which walking behavior is shaped from scooting behavior, it is possible that the newly differentiated response leads to such massive environmental changes for the subject that reversal is impossible. A child who now walks, rather than scooting on the floor, comes into contact with many new toys that were previously unavailable, more immediate contact with the stimuli in his environment, and a rich schedule of adult attention, due at least in part to increased mobility on the child's part. Also adults will certainly observe the obvious difference in the child's behavior (social interaction may not be so obvious), and an immediate response on their part should occur, especially since the child's altered behavior does remove many aversive stimuli for the parent.

It would therefore appear that even though the principles are the same across behavior modification studies, there are alternative designs experimenters may have to use in an individual analysis approach to modifying problem behaviors. Hence, the modification principles may not separate the areas of rehabilitation or child therapy as Bijou and Baer agree, but perhaps different experimental designs are necessary to enable the experimenter to demonstrate his effectiveness.

An experimental design incorporating reversal procedures to demonstrate controlled modification, does not seem applicable for those behaviors which, when finally emitted, produce massive environmental consequences beyond the immediate contingencies surrounding the specific behavior that was modified. It is quite possible that these environmental consequences will quickly begin to exert more control over the behavior, once established, then the limited variety of reinforcers available in any experimental setting. Thus, in such situations the probability of obtaining a sustained reversal of the newly acquired behavior or an increase in the less desirable behavior, which produces fewer environmental consequences for the child, is quite small.

Another design which could demonstrate, equally well, experimental control of the modified behavior without using reversal procedures would seem more applicable. One such design is the multiple or concurrent baseline procedure. In such a design, several behaviors are observed concurrently so that an operant (baseline) level is established for all of them. The categories of these behaviors to be chosen are: 1) The behaviors the experimenter choses to manipulate; 2) Those he may want to observe for generalization effects of the manipulations; and 3) Those which may be altered as a consequence of manipulating other behavior but which do not necessarily lie on the generalization continuum. Subsequent to obtaining the operant levels of these behaviors, modification procedures are applied to one of the behaviors to be modified while all other behaviors remain under continuous observation. When this first behavior begins to show the desired directional change then procedures are begun for the second, third, etc. If there is a change in the responses of the subject following manipulation procedures for the particular response being modified and if this process is replicated across behaviors for the same subject, it then appears highly probable that it is the experimental procedures which are responsible for these behavioral changes and not some unknown correlated incident.

Baer and Sherman (in press) have described in detail a design such as the one above for use with operant therapy studies. Meyerson, et al. (1967) reported several procedures employed to teach a mentally retarded child to walk. They collected data on several different aspects of her walking behavior and presented the sequence of changes across training sessions. This design approximates the multiple baseline design but is limited because their data is based only on the behavior emitted in the training session. This type of data is extremely susceptible to the training and reinforcement procedures used.

Optimally, a multiple baseline design is best applied when the experimenter trains the subject in the natural environment. Then those behaviors under observation are "free" to be emitted or not, thus providing a constant baseline of several behaviors which can be compared during and after specific training procedures. This "freedom" is not provided in restrictive or atypical environmental settings. This would mean that modification produced within the natural environment and measured there or that produced in a laboratory setting and measured in the natural setting could provide fruitful data concerning the effects of modification procedures.

The study reported in this paper utilizes a multiple baseline procedure. Behaviors were chosen for observation prior to the beginning of the study and procedures worked out for observing and recording data. Although modification of the behavior was carried out in a laboratory setting, the majority of the observations plotted were in a natural setting. Baseline data was collected on all behaviors. One at a time modification procedures were applied to each of the behaviors to be modified. The design was chosen because we suspected that gross motor behaviors such as walking, getting up from the floor unsupported, and climbing steps was one of the categories of behavior which would be difficult to reverse because of the large number of additional reinforcers which are available and which probably have more reinforcement value than those reinforcers used originally to modify the behavior.

METHOD

Subject

The subject was a 31-month-old male attending the University of Kansas Infant Study Laboratory when the study began. A medical diagnosis included a suspected arrest of hydrocephalus. The slow development in both motor and language areas was therefore attributed to congenital brain damage. He was also a subject in another experiment during this time.

Although most of the components of a full-blown walking response had been observed to be a part of S's repertoire, his walking behavior appeared to be under the stimulus control of certain environmental props affording support. He exhibited a walking response only when some supportive agent was available. S's consistent response when support was withdrawn was to sit down on the floor immediately. His primary means of locomotion was to sit on the floor and scoot by pulling his body forward with the combined force of his legs and arms. S's parents reported repeated unsuccessful attempts to get him to take a few steps alone.

Experimental Design

During informal observations of S in the Infant Study Laboratory and from conferences with his parents and preschool teacher, a group of behaviors were decided upon for observation and possible modification. Two general categories of these behaviors were used: 1) those which were desirable, i.e., standing, walking, getting up, and climbing stairs without support; and 2) those which were incompatible (could not be emitted simultaneously) with the desirable, i.e., not standing, scooting, pulling up with support and not climbing stairs. These were further classified into: 1) Those behaviors to be increased in occurrence through experimental procedures, i.e., walking, getting up, and climbing stairs without support; 2) Those behaviors to be decreased through experimental procedures, i.e., scooting, pulling up, and not stair climbing; and 3) Those behaviors which might not need direct modification but might increase as a result of increasing desirable behaviors and decreasing behavior incompatible with the desirable ones, i.e., standing without support. It should be noted that the behaviors chosen to increase during modification procedures were at a zero operant (baseline) level as was the behavior determined not to require direct modification.

The design therefore follows the multiple baseline approach. Figure 1 represents a smoothed graphic conceptualization of how the data might appear in such a design over the course of the study. From the graph it can be seen

---

Insert Figure 1 about here

---

that sitting and scooting behavior were anticipated to appear at high frequencies of occurrence during baseline. Our preliminary observations indicated that walking, standing without support, getting up without support and step climbing would all be at zero operant level during baseline and would remain there until training on each of the separate behaviors was begun. The behavior that was not to be trained (standing without support) was expected to increase in rate sometime after the actual walking began. Further, we expected sitting to begin to decrease soon after walking began but to level out at an appropriate point since all preschool children do sit for periods during the classroom session.

The frequency of scooting, on the other hand was expected to rapidly decrease after walking began but not to a zero response rate until after S was trained to get up from the floor without support. Walking, step climbing and getting up without support were expected to remain at their zero baseline levels until specific training for each of these behaviors began. Additionally, because the observations were being recorded in the child's natural preschool environment, and the training in an experimental room, it was thought that some time would elapse before the effects of training would generalize to the preschool setting. Therefore increases in walking, getting up and step climbing should be somewhat delayed in rate increase subsequent to the onset of training.

Experimental and Observation Settings

The first experimental training area was a large, relatively bare room with a small observation room adjacent to it. This room was located in the University of Kansas Infant Study Laboratory.[3] The second experimental area was another large, relatively bare room (though more objects were present along the walls, such as chairs and tables) with an observation booth extending the full length of one wall. This room was located in the Preschool Laboratory on the second floor. A training area, used for a short while during the final training procedures was the actual classroom of the Preschool Laboratory, which consisted of two quite large, connected rooms equipped with the standard nursery school materials. There were 20 children ranging in age from three to five, attending the summer preschool session during which the final phases of this study were completed.

Observations of S's behaviors were recorded in the above experimental training areas in addition to the Infant Study Laboratory classroom in the initial phases of study. This classroom was a large playroom also equipped with the standard nursery school materials. There were a total of five children, ranging from 25 to 31 months of age, attending the same 1½ hour session as S. The class sessions were held twice a week with the same group of children and the daily schedule consisted of 45 minutes of free play, followed by handwashing and a snack and then another shorter play period which was frequently held outside, weather permitting. Approximately one month after the classroom observations in the Infant Study Laboratory were discontinued in the summer, observations were also recorded in a private nursery. The differences between this setting and the Infant Study Laboratory were that 20 children were in attendance and the age range was from 3 to 4 years. Also movement was somewhat restricted because the majority of the activities were carried out while seated at a table.

Recording of Observations:

At the beginning of the study three observers were trained to record S's motor behaviors in the classroom setting. The observers were simultaneously employed as research assistants for the University of Kansas Head Start Evaluation and Research Center and consequently, had a considerable amount of previous training and experience in observation and recording.

Categories of motor responses to be observed were decided upon. Table 1 presents the symbols for each category and corresponding response definitions.

Insert Table 1 about here

Observation recording sheets were divided into blocks representing 15-second intervals. If two or more different responses occurred within any 15-second interval, the corresponding symbols were all recorded in the block for that interval. If the same response occurred twice within one interval (e.g., walking more than 2 steps), the corresponding symbol was recorded only once in the block for that interval. Therefore, the percentages plotted on the graphs reflect percentages of 15" intervals in which a particular behavior occurred.

The reliability of all three observers was checked periodically throughout the study.[4] After a high degree of interobserver reliability had been established in the initial phases of the study, three observers were not used every day. Most observations were recorded simultaneously by at least two observers but for some days only one observer recorded.

This method of observation was used as an ongoing generalization measure of the responses being shaped in the training sessions. Therefore observations were recorded in the classroom setting of the Infant Study Laboratory until it was discontinued for the summer, for two days in a private nursery setting during the summer, and for three days in the middle of the summer at the Preschool Laboratory summer session.

Within the training sessions it was impossible for an observer to reliably record those behaviors chosen for training. Because gradual changes in the response topographies were the objectives of the training session procedures, it was impossible for an observer to reliably record those behaviors chosen for training during their acquisition. One reason this was impossible was because a shift in support used by S was a criterion for differential reinforcement. Because E was physically manipulating this support she could determine the amount of weight or pressure S applied to the supportive agent. These shifts were felt by E only and visually observed by no one. It was also impossible to establish criteria which could be used for recording lifting feet. These responses occurred too rapidly in succession for reliable measureable recording. Furthermore, to isolate the effects of E's delivery of reinforcers upon the observer's judgement of the specific response in question could not be done. Therefore during the training sessions the observer recorded only time, number of reinforcers, auditory and discriminative stimuli presented by E, specified response emitted by S and unusual occurrences in the sessions. The combined data obtained from probe test sessions which occurred after each training session and movies filmed during each phase of the training sequence, were the criterion upon which the decisions were made for altering training procedures and/or moving forward within a specific unit of training.

Probe Tests

Probe tests were administered during all three phases of training: 1) Walking-Training, 2) Getting-Up-Training, and 3) Step-Climbing-Training.

During the Walking Training Probe Tests, it was necessary to take S to a room other than the experimental room because he was never permitted to scoot in the experimental room during the initial phases of training. In the probe room, a toy was placed in the corner and a table in the middle. E placed S standing beside a table. S was told to come to E who had moved to the corner beside the toy. S was permitted to use any method of locomotion he chose and no supports were available for him to use. The response measures recorded during this phase were the number of steps and the number of scoots S emitted in reaching E and the toy.

Because getting-up training was started while step-climbing training was ongoing, the probes from the step climbing provided the probe data for getting up without support. Films taken of the training sessions were subsequently analyzed to determine the response acquisition.

To probe test step climbing, three 4" steps were set up in an arrangement which allowed S to climb up three, walk across the top, and climb down three. S was allowed to use any means of locomotion he chose to get to the top where a toy had been placed. After playing with the toy for a few seconds, E stood S up, if he was sitting or in a crawling or scooting position, and then allowed him to go down the steps, under whatever means of locomotion he chose, to obtain a toy from a table at the foot of the steps. All probes were filmed, as well as S's stair-climbing behavior in the University Preschool Laboratory.

The use of probes subsequent to experimental sessions compounds the experimental design, i.e., the probes were used to test the effectiveness of the experimental session training in terms of response acquisition, and the continuous observation recordings in other settings provided information regarding the use of these responses in those settings (generalization of response to new environments). Such a design provides information to the experimenter regarding when the response is acquired, and subsequently when it becomes strong enough to generalize to other environments without specific procedures provided for generalization. Since this information is available simultaneous with training, it is possible to use it for guiding the experimenter when making training decisions.

Reinforcers

It had been noted prior to the initiation of training procedures, that opportunities to handle and play with toys could possibly serve as a reinforcer for S. However, the difficulties involved in immediate delivery of such reinforcers, contingent upon subtle variations in S's behavior; in addition to the frequent interruptions of training to allow S to play with the toy, made using this as the sole reinforcer impractical. Therefore, S's parents were asked to feed him an early lunch and skip his usual post-nap snack in order to increase the effectiveness of small edibles as reinforcers. The opportunity to play with a toy was therefore made contingent upon a fairly long series of small responses, some of which were differentially reinforced with the edibles.

Single steps, or a small series of steps, were differentially reinforced for those variations determined by E to be closer to independent walking behavior. These variances, upon which the judgements were made, were: decreasing the amount of weight which was placed upon the supportive object, decreasing the firmness of grip on the support, taking steps in a forward direction rather than sideways, and lifting his feet off the ground rather than shuffling. Similar procedures were used for shaping the components of the "Getting-Up" response and the "Climbing-Steps" response.

At one point in step-climbing training, a conditioned reinforcer, in the form of a "token" (small plastic chip), was used. After climbing up and down the steps, S was permitted to take a token from a cup and put it into a box. When all the tokens were transferred from the cup to the box, they could be redeemed for a small toy which S could keep. The conditioned reinforcers were not very effective for maintaining S's step climbing, possibly because the response requirement was out of proportion to the conditioned value of the reinforcer. Because of the interruptive qualities of beginning at the first stages of establishing a conditioned reinforcer, i.e., presenting the token and allowing immediate trade for small edibles, the token procedure was discontinued after only a few sessions in favor of the original reinforcement procedures.

Pretraining

For purposes of gaining instructional control, i.e. for E's vocal instructions to become auditory stimuli discriminative for reinforcement subsequent to a correct response following the instruction, a series of shaping procedures were initiated. E stood S next to a low table for support and issued the auditory stimulus, "S, come here". If S moved only a few inches in E's direction, reinforcement was delivered. The distance between E and S was gradually increased until S was walking with support for ten feet.

It was anticipated that certain elements of the program for training walking without support would require S to emit matched-dependent, imitative behavior. E presented the auditory stimulus, "S, do this," and demonstrated physical models of simple motor behaviors, such as tapping the table, holding up one hand, etc. (Baer, et al., 1967). The purpose of this procedure was to extablish an imitative repertoire for S over a wide range of behaviors and thus provide the tool of imitation for shaping elements of other behaviors.

General Procedures

Although S did not stand without support it was posited that this response would become a part of S's repertoire as he began to walk without support, to get up from a sitting position, and to climb steps. Therefore, these latter behaviors which also had zero occurrence rates on the recorded observations, determined the phases of the experimental training program.

Walking Training. The principle objective of the walking program was to effect changes in the topography of S's walking behavior such that he would acquire sufficient control and balance to be able to walk independently of any supporting agent and without excessive unsteadiness.

Since S's walking behavior was fully dependent on the use of some agent that offered physical support, the general purpose of one of the procedures was to gradually withdraw support which was provided initially. This procedure is closely related to fading, a programming term used to refer to "the gradual withdrawal of stimulus support", (Holland, 1960).

The fading procedure used for training walking without support involved a gradual withdrawal of the amount of physical support a stimulus offered for a motor response rather than a systematic fading of the visual or auditory cues offered by the stimuli used in other types of training that have utilized fading techniques. (Bijou, In press).

A series of supportive stimuli was developed which ranged along a continuum from highly supportive (in terms of the physical properties of the stimulus, primarily rigidity and steadiness) to functionally non-supportive along the physical dimension. The stimuli used were: E's hand, E's finger, a round wooden stick 3/4 in. in diameter, a slightly flexible round wooden stick 1/4 in. in diameter, a very flexible spring about 1/2 in. in diameter, a piece of clothesline rope, taut at first then gradually slackened, and finally a piece of thin string. The last step involved was the terminal goal of walking without support.

Each of the stimuli, except for E's hand and finger, was about two to three feet in length. The length of these objects made it possible for E to gradually move farther away from S, who was holding the opposite end, while still holding the stick, spring, or rope. By moving her grasp farther away from the point at which S was holding the object, E's control over the steadiness of the support was decreased. The elements involved in support were thus faded along three dimensions: the rigidity of the object itself, the steadiness of the object, and the proximity of E's grasp to S's (which also moved E farther from S).

When S entered the room he was taken to the center of the room (while holding E's hand) and given whatever supportive stimulus he was currently using. E suggested that she and S walk across the room to one of the toy corners. As they were walking, E delivered the edibles directly from her apron pocket into S's mouth following any changes in S's behavior. At times E instructed S to walk straight ahead or to lift his feet higher. If S complied, reinforcers were delivered. When S held E's hand or the stick very loosely or did not bear down with much of his weight on the hand or stick, he was also given a piece of candy. Once he arrived at the corner, he was allowed to play with the toy for a few seconds.

After six sessions of about fifteen minutes each, S had moved from holding E's hand, to her finger, and then to the larger stick which E now held about 18" from S's hand. A new procedure was introduced into the session along with the fading procedure (Meyerson, et al., 1967). Although S's progress had been satisfactory under the initial procedures, the new technique was introduced to see if the combination of procedures would speed acquisition of independent walking behavior. Two chairs were placed back to back, 24" apart. S was placed between the chairs with both hands on the back of one chair. E stood in front of the other chair and said, "S, come over here." S turned, placed one hand on the back of the opposite chair in front of E, then the other hand, and was given a bit of candy. E then stood in front of the other chair and repeated the procedure, each time moving the chairs slightly farther apart. By the end of the first session with this technique, the chairs were approximately 42" apart, a little beyond S's arm span, thus requiring at least one unsupported step.

In the next session, the chairs were placed 36" apart and by the end of the session were 56" apart, thus requiring about 3 or 4 small unsupported steps. In the third session of this condition the chairs were placed 48" apart and were extended to 78"; requiring about 5 or 6 small steps.

After only seven sessions S had begun taking steps without support in various other settings, as indicated from the recorded generalization observations. He was consequently coming into contact with a greater variety of reinforcers over longer periods of time than the short experimental sessions three times a week. It was decided that a reversal should be attempted within the experimental sessions before the behavior was no longer under the control of the stimuli in the experimental setting. The independent walking response was rapidly becoming very strong and the possibility of obtaining a reversal within the experimental and probe sessions was questionable. Nevertheless, a reversal was attempted.

The basic design for the reversal was essentially the same as that for the training sessions with only the contingencies reversed. Scooting behavior was reinforced with small edibles and toys in these sessions. The toys were removed from the corners and a variety of small toys were placed in E's pocket. S was taken to the center of the bare room and allowed to walk around freely. E then sat down on the floor and called S. If S came and sat down on the floor, reinforcement was delivered. E then placed a toy on the floor about 5 feet away from S. As S scooted across the floor to the toy, food reinforcers were given and he got to play with the toy. E continued to place toys in various places on the floor and presented reinforcers to S for scooting to the toys. S made no independent attempts to get up and walk around.

After S had experienced reinforcement contingent on scooting for several minutes, E instructed S to come to the shelf and pull himself up to a standing position. This procedure provided S with a chance to experience nonavailability of reinforcers while he was walking. As long as S was walking around the room, E did not attend to him, and he did not obtain any toys to play with.

As soon as S was standing, E would go across the room and put a toy on the floor. If S attempted to walk over and pick up the toy, E would remove it. If, however, S sat down and scooted toward the toy, E would give him an edible as he was scooting and would let him play with the toy for a few seconds.

The reversal procedures were used for three, 15-minute sessions, each of which was followed by a filmed probe. After this, two more sessions were held in which the reinforcers were once again contingent on walking. Probes were also recorded following these two sessions.

Getting-up Training. After S began walking independently, the classroom generalization observations revealed that although walking behavior was increasing, scooting behavior was not decreasing. A possible explanation is that S had never learned to get up from a sitting position on the floor without using a table or similar object to pull himself up. Since all the children in the classroom frequently sat on the floor to play, it was necessary to get up from the floor to walk to any other part of the room. S was frequently observed remaining on the floor and scooting to another area or scooting from his place on the floor to the nearest table and pulling himself up.

The basic reinforcement technique which seemed to have been a critical variable in developing the independent walking response was also used to shape this response, though the specific training procedures differed from those in the walking program. The sudden development of this new response, following application of reinforcement procedures similar to those of the walking program, points to the use of differential reinforcement as critical for shaping the independent walking response.

The total response of getting up without support was broken down into several small components. During the training sessions, E sat on the floor next to S and modeled the first response component of placing the legs straight in front. The model was preceded by the verbal statement, "S, do this." If S imitated E's model, a bit of candy was presented. All components were demonstrated and responded to in this manner until the entire chain of responses involved in getting up had been modelled and imitated. Briefly, the total chain consisted of sitting on floor with legs stretched out in front; shifting weight to one side or hip; pulling knees toward body while leaning to weighted side; putting arm from unweighted side across body on floor; lifting all weight to kneeling position with hands on floor; each foot placed on floor individually while supported by hands on floor; straightening back to standing position.

The training for "getting up" was carried out during steps training. The simple "getting up" sequence was used as a break from the step-training. The entire sequence for getting up was repeated a total of ten times over six step-training sessions. During the initial phases it was necessary to administer some physical assistance which was gradually decreased. The final three sequences were executed with no physical assistance.

Step-Climbing Training. Once the independent walking response was firmly established, the basic reinforcement and fading procedures used in the walking program were applied to train walking up and down steps without support. Rather than continuing to attempt a reversal of the walking behavior it was decided to use the same procedures which shaped walking to shape a second response with a zero operant level. If these same procedures resulted in increasing the rate of this second behavior then procedural efficacy would be demonstrated.

In the step training two different fading procedures were used: 1) gradual withdrawal of the physical support of the same supportive objects as used for training walking, and 2) gradual increases in the height and number of steps on which S was being trained. The criterion behavior was for S to walk up and down three, 4" steps without using any person or object for support.

A special set of steps was constructed consisting of two wooden boxes, each of three sizes, 20" X 52" X 2", 20" X 86" X 2", and 20" X 36" X 2". When all the boxes were in position, they provided three full steps for going up one side and down the other. The boxes could be used in any combination of 2" or 4" steps, thus allowing for gradual increases in both the height and number of steps.

During the first five sessions, only one box was used, providing one 2" step up and one 2" step down. A table filled with a variety of small toys was placed near the foot of the steps which S walked down. E began the first session by placing S on the platform and helping him step down, using her hand for support The step down gained access to the toys on the table for S. He was permitted to play with one toy for a few seconds and to carry it over to a shelf about two feet away and put it down. The stepping down with E's help was repeated several times before S was taken to the other end of the platform and assisted in stepping up. He received an edible for this response. Once having stepped up onto the platform, S walked across and stepped down, again gaining access to a toy from the table.

Support was gradually shifted from E's hand to the larger stick, and to less supportive objects over the five sessions. During the fifth session, S held one end of the clothesline rope and E the other. The rope was held taut initially and was gradually slackened until there was no physical support afforded by the rope. However, when E attempted to let go of her end of the rope, S offered much resistance. To eliminate the visual stimulus of the rope, E tied the rope around S's waist and held one end behind his back. E kept her hand on the rope and put slight pressure on S's back after assuring him she would hold him in back. It was then possible to gradually decrease the pressure stimulus on S's back until E was no longer touching either S or the rope but simply keeping her hand behind S's back. The effectiveness of this procedure indicated its possible efficacy for future use during entire training sequences of this type.

Once S was walking up and down without any support, a question arose as to whether the next step in training should be to increase the step from 2" to 4" or to add a second 2" step up and down while leaving the bottom step at 2". It was decided to try one 4" step. After a few sessions, S's increased hesitation, resistance, and lack of adequate muscular control of his knees indicated that this was possibly not the better course of action. Combinations of increased step height and increased number of steps were tried, but S made very little progress, particularly in stepping down.

It was observed that: 1) S did not look at the step before putting his foot down, thus often overstepping the edge of the lower step and losing balance; 2) The original balance S gained had regressed; and 3) The knee of the leg remaining on the higher step as the other foot was lowered to the next step was not bending. Thus three procedures were instituted to handle these difficulties: 1) Pictures were taped to the steps and S was told to "Step on the dog" (or whatever was represented in the picture); 2) E reverted to giving S a stick to hold onto for balance; and 3) E pushed S's knee from the back as he began to step down. Physical assistance for knee bending was gradually decreased as S began bending his knee and thus increasing the muscular control he had over weight shift. Then the supportive agent was gradually removed.

At this point, S began attending the summer session at the Kansas Univ. Pre-School, and his private sessions were discontinued in favor of working with him intermittently within the classroom setting at the Pre-School. The steps (three 2" steps without pictures) were placed in an open area of the room, accessible to all the children. S did not approach the steps at all until asked to do so by E. After S had completed the sequence several times, following E's requests and had received edibles and toys, two of the children who often played with S were asked by E to help S learn to walk on the steps. The children were shown how to get S started and where to stand as S was walking on the steps. As soon as S had completed the sequence, the child would give S an edible and subsequently receive one for himself from E. The children had S going up, over, and down the steps as many as 20 times in a 75-minute period. Once walking over the 2" steps was fairly well established, the bottom step was increased to 4" height. A few days later, the middle step was also increased. On the last two days of school, the top step was raised to a height of 4" making all three steps now 4" high. These conditions represented the original criterion response and matched those of the probe tests. No reversal of the stair-climbing behavior was attempted.

RESULTS

The conceptualization presented in Fig. 1, was not intended to predict or present the results of this study, but rather to depict, prior to the implementation of experimental procedures, the possible points at which each behavior might begin to show changes as a function of the planned procedures. As can be noted, the procedural sequence presented in the conceptualization is not the same as that actually followed in the training sessions. For example, the point at which Getting-Up Training appears on this graph is not in accord with the actual procedures of the study since Getting-Up Training occurred following the initiation of step climbing (but during its training) and not before.

Figures 2, 4, 5, 6, and 7 are depicting response generalization to the preschool setting, i.e., walking with and without support, sitting, scooting, standing with and without support, and getting up with and without support respectively. Figures 2, 4, 5, and 6 represent a percentage of total recorded intervals for any one observation day rather than percentage of total time. It should be remembered in reading these graphs that the dependent variables were counted in the number of 15" intervals in which a particular behavior was emitted at least once. Therefore, it is possible for all the behaviors being observed to be recorded in any one 15" interval, regardless of their mutual exclusiveness. The days of observation recording were not continuous but rather intermittent since S attended the preschool only two days a week.

At the time of this writing the final data on step climbing have not been completely analyzed. The films and data from Step Climbing Training are not yet available. This particular response is also not recorded in the generalization graphs because it was not possible to present comparative data on this behavior due to the infrequent opportunities for S to emit step climbing behavior in the preschool setting.

Walking Training Results

Walking without support did not immediately generalize to the preschool environment following the onset of a few independent walking steps in the training sessions. However, once the unsupported walking response was emitted in the daily environment, the rate of this response increased rapidly beyond that of supported walking. Unsupported walking never again decreased to a point below supported walking, even though the latter never decreased to the zero operant level. This non-elimination of supported walking could be partially due to the "natural" behavior of three-year-olds of holding someone's hand when walking to a specified point or when going outside. The combined behaviors, walking with and without support, increased across observation sessions, which indicates not only an increase in walking without support, but also a general increase in total time spent walking.

Figure 3 shows the probe tests carried out during the walking program that were introduced to measure behavior during the reversal procedure. Nine probes are graphed, four of which were immediately preceeding reversal, three during and two immediately following the reversal procedures. Probe 5 of the reversal period reflects a tendency toward a reversal of trends of the two behaviors, walking with and without support. Probe 6 does, in fact, represent a complete reversal of the trends. However, Probe 7, which is still under reversal conditions shows that it is, in fact, quite difficult to consistently reverse this type of behavior. Once reinforcement was reinstated for walking the behavior increased rapidly.

As would be expected, scooting (Fig. 5) decreased in almost direct proportion to the increase in the rate of walking behavior. Also, the scooting slope decelerates more rapidly across time than did the walking with support (Fig.2).

Sitting (Fig.4) did not decrease with the same rapidity as walking increased. However, there was a continuous deceleration over time. Because walking would not be expected to replace sitting as it would scooting, and because sitting would be expected to occur at about equal frequency to walking and standing in the usual preschool settings, this slow but steady decline was not at all surprising. There is a sharp decline in sitting which corresponds to a sharp rise in walking without support during the four observations recorded at the last preschool setting. This preschool setting in which S was observed at the time of these abrupt changes afforded more opportunities to walk and stand and less to sit than had the two previous environmental settings.

Fig. 6 indicates that standing without support showed slight increases shortly after the onset of Walking Training, but did not increase sharply until much later. On the other hand, the slope representing standing with support indicates only limited decreases and this behavior never reached the near zero operant level. These were the behaviors which were being observed to determine what effects, if any, would be shown upon their rates as a result of the training procedures and the modification of other different but related behaviors. It was reported by the observers that S tended to lean against tables, chairs, etc., while he was standing. Such a tendency would result in a graphic presentation which shows little change over time. When the frequencies of standing with support and standing without support are totaled, it is quite apparent that S is, in fact standing more often as opposed to sitting.

Getting-Up Training Results

The results subsequent to Getting-Up Training (Fig. 7) indicate that S learned rapidly to get up without support, a previously zero operant level behavior. The mutually exclusive behavior, getting up with support, exchanged places with this training behavior in decreasing to a zero operant level. These data, when compared with the other generalization data, for days 12 through 22, show little effects on other behavior, including standing with and without support. One exception to this is that when getting up with support increased scooting behavior (Fig. 5) finally decreased to the zero baseline level. The observers reported that during observations for days 12 through 16, S's scooting behavior also depicted a qualitative change which was not reflected in the quantitative graphs. Apparently the only time S was scooting were times when he was sitting on the floor and would scoot to a table or chair in order to pull himself up to a standing position. Therefore this behavior was qualitatively different from the scooting responses previously used almost constantly for transportation.

In Fig. 8 the actual data collected in the study is presented in a multiple baseline schema. This figure when compared with Fig. 1 indicates that in general

---

Insert Fig. 8 about here

---

the actual data follows the anticipated increases and decreases of specific behaviors that were planned at the start of the study.

DISCUSSION

The use of a multiple baseline design for those behaviors that are judged to be difficult to reverse was demonstrated in this study. Although a reversal procedure was attempted it appeared that it was not stable.

When using this design an initial and complete selection of behavior categories to be observed throughout the entire study should be stressed. This is also true for sub-divisions of observed major behaviors. For example, if the observation procedure had allowed for a breakdown of standing with support such that it could differ between social holding contact with people and holding on or being supported by inanimate objects then further information would have been realized from this study. Although it is impossible to pre-guess all categorie that may be desirable to observe, careful attention prior to the implementation of the study in this area must be given.

Besides serving as a demonstration for a multiple baseline design, this study also serves as an example of the types of procedures that can be used in shaping walking, getting up without support and step climbing. There was nc attempt to test or stress one procedure as being more definitive in obtaining the desired response than another. The guiding approach in all training was the use of shaping procedures. By starting with a response S could emit and slowly re inforcing closer approximations to the terminal response it was possible to modify the behavior, maintain a motivational system, and avoid resistence behaviors Only when the shaping procedures moved too quickly did progress break down. The use of fading E's prompts was also an important procedure used concurrently with shaping. Final conclusions cannot be stated until an analysis of the data on step-climbing is completed.

FOOTNOTES

[1]The research reported herein was partially supported through a contract with the Office of Economic Opportunity, Executive Office of the President, Washington, D.C. 20506. The opinions expressed herein are those of the authors and should not be construed as representing the opinions or policy of any agency of the United States Givernment.

[2]Now at Webster College, Webster Groves, Missouri.

[3]The authors wish to thank Mrs. Aleta Cooper, Head Teacher, the University of Kansas Infant Study Center; Mrs. Beatrice Lott, Nurse, University of Kansas Preschool Laboratory; Miss Margaret Cooper, Head Teacher, Preschool Laboratory and our subject's parents for their help and excellent cooperation during the course of the study.

[4]The reliability for all behaviors was consistently above 90% for all observers. The authors wish to thank Mrs. Li bly Ralston, Mrs. Cathy Silver and Mrs. Bonnie Flemming for their help with the collection of the observation data.

Michaelis, Etzel

REFERENCES

Baer, D.M. The entry into natural communities of reinforcement. Paper read at the Annual Meeting of the American Psychological Association, Washington, D.C., September, 1967.

Baer, D.M., Peterson, R.F., and Sherman, J.A. The development of imitation by reinforcing behavioral similarity to a model. J. exp. anal. Behav., 1967, 10, 405-416.

Baer, D.M. and Sherman, J.A. Operant therapy techniques. In C.M. Franks (Ed.), Assessment of the behavioral therapies. New York, McGraw-Hill, (In press.)

Bijou, S.W. Studies in the experimental development of left-right concepts in retarded children using fading techniques. In N. Ellis (Ed.), International review of research in mental retardation, Vol. III. New York, Academic Press. In press.

Bijou, S.W. and Baer, D.M. (Eds.), Child development: readings in experimental analysis. Editors' comments pg. 214. Appleton-Century-Crofts, New York, 1967.

Harris, Florence R., Johnston, Margaret K., Kelly, C. Susan, and Wolf, M.M. Effects of positive social reinforcement on regressed crawling of a nursery school child. J. educ. Psychol., 1964, 55, 35-41.

Holland, J.G. Teaching machines: An application of principles from the laboratory. J. exp. anal. Behav., 1960, 3, 275-287.

Lovaas, O.I., Freitag, G., Gold, Vivian J., and Kassorla, Irene C. Experimental studies in childhood schizophrenia. I. Analysis of self-destructive behavior. J. exp. child Psychol., 1965, 2, 67-84.

Meyerson, L., Kerr, Nancy, and Michael, J.L. Behavior modification in rehabilitation. In S. W. Bijou and D. M. Baer (Eds.), Child development: Readings in experimental analysis. Appleton-Century-Crofts, New York. 1967, 214-239.

Wolf, M.M., Risley, T.R. and Mees, H.L. Application of operant conditioning procedures to the behvior problems of an autistic child. Behav. res. Ther., 1964, 1, 305-312.

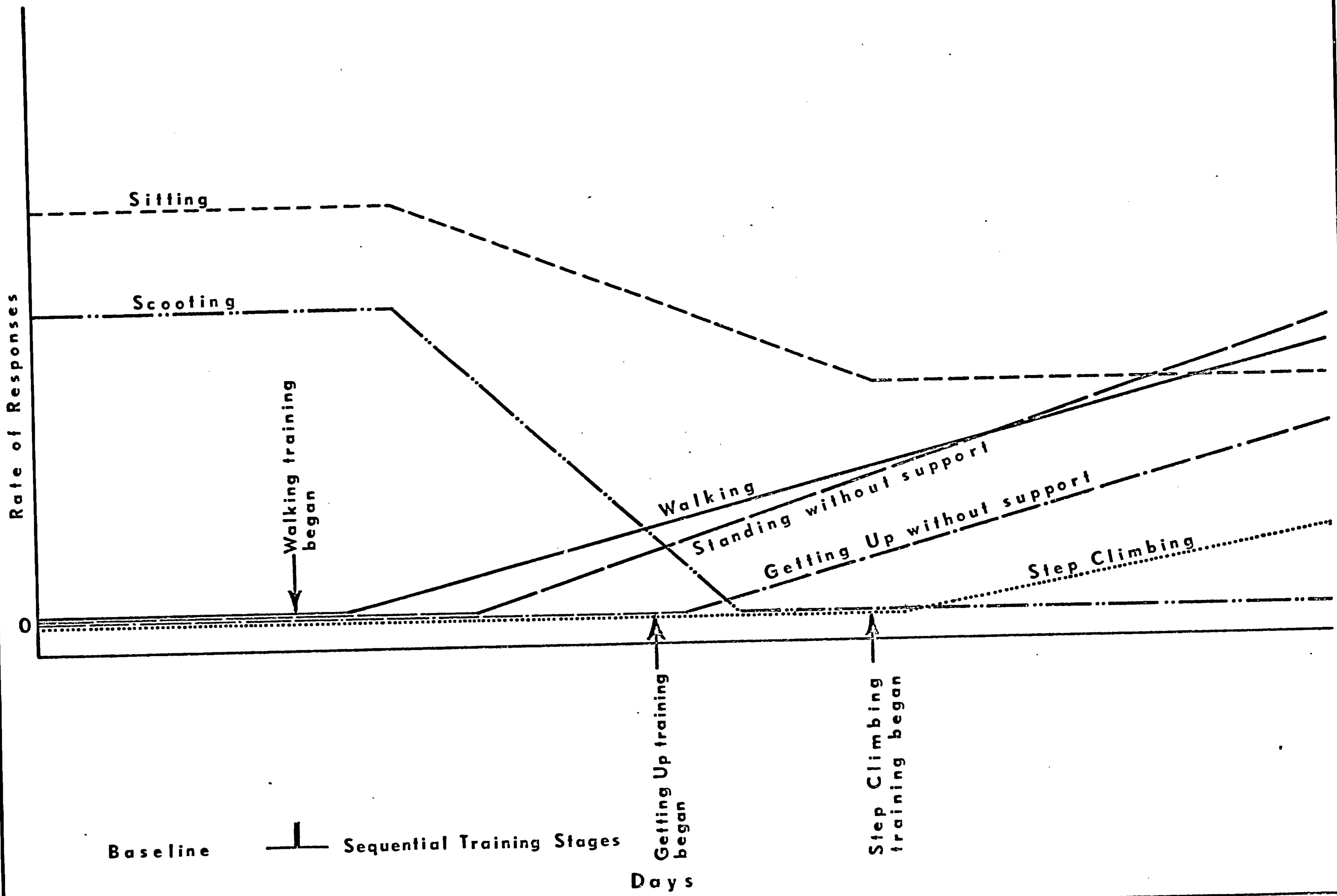
Figure Captions

Figure 1	A schematic of the multiple baseline design of this study prior to implementation.
Figure 2	Percent of 15 second intervals of walking with support and walking without support across three preschool settings: before and after walking training.
Figure 3	Percentage of steps taken and scoots of combined total movements during pre-reversal, reversal, and post-reversal phases.
Figure 4	Percent of 15 second intervals of sitting across three preschool settings: before and after walking training.
Figure 5	Percent of 15 second intervals of scooting across three preschool settings: before and after walking training.
Figure 6	Percent of 15 second intervals of standing with support and standing without support across three preschool settings: before and after walking training.
Figure 7	Number of responses per day of getting up with support and getting up without support before and after training.
Figure 8	Results of the multiple baseline design: percent of 15 second intervals of sitting, scooting, walking, standing without support on left ordinate; and number of responses per day of getting-up without support on the right ordinate.
Table 1	Response categories and scoring symbols used in observing S in the three preschool settings.

Table 1 -- Response categories and scoring symbols used in observing S in the three preschool settings.

SYMBOL	RESPONSE	DEFINITION
S	Sitting	Sitting down in chair or on floor or large toy for at least 3 seconds.
C	Scooting	Moving about while in sitting positions on floor by pulling self with legs and arms, making at least 2 complete pulling movements to be counted as C.
O	Standing with support	Standing on both feet while holding onto or leaning against some supportive environmental object, maintaining this position for at least 3 seconds.
Ø	Standing without Support	Standing on both feet without holding onto or leaning against any supportive agent, maintaining this position for at least three seconds.
/	Walking with support	Taking at least 2 steps, i.e., picking up each foot at least once and putting it down in a place other than the one from which it was picked up, all while holding onto some supportive object or person.
X	Walking without Support	Taking at least two steps totally without the support of any object or person.
H	Being Held, picked up, or lying on the floor	These diverse observations were all grouped under the symbol H because they did not have any specific relevance to the behaviors under study and also because they rarely constituted more than one per cent of a single day's observations since they occurred so infrequently.
P	Getting up from sitting position on floor with support	Reaching up to top of chair, low table, or shelf and pulling rest of body up mainly through strength of arms.
P/	Getting up from sitting position on floor without support	Getting to standing position without the use of any other object in the environment usually by turning over onto knees, then to feet, then lifting rest of body to upright position.

Fig.1-Conceptual Diagram of Multiple Baseline Design of this Study Prior to Implementation



rig.2 - Walking With and Without Support

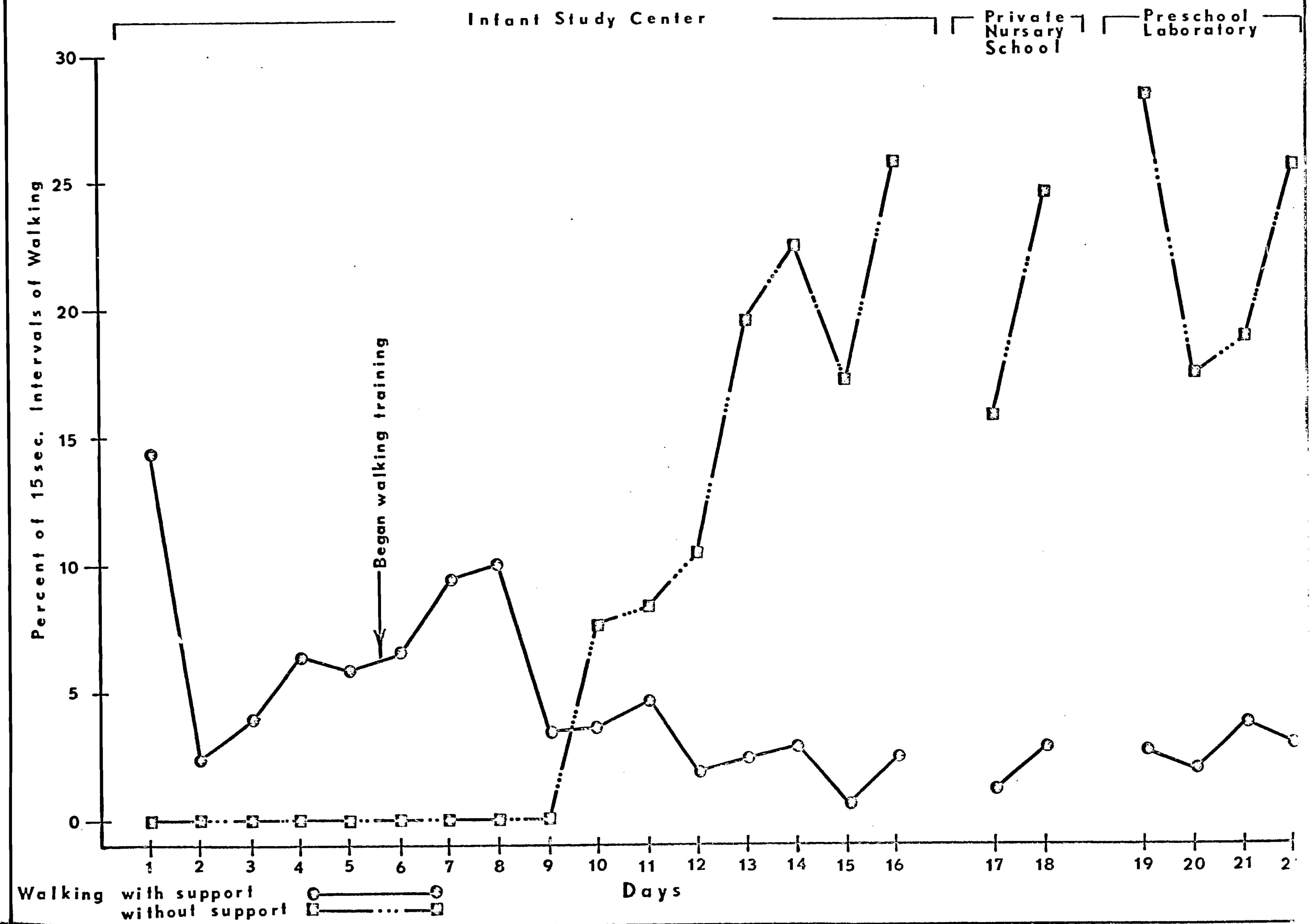
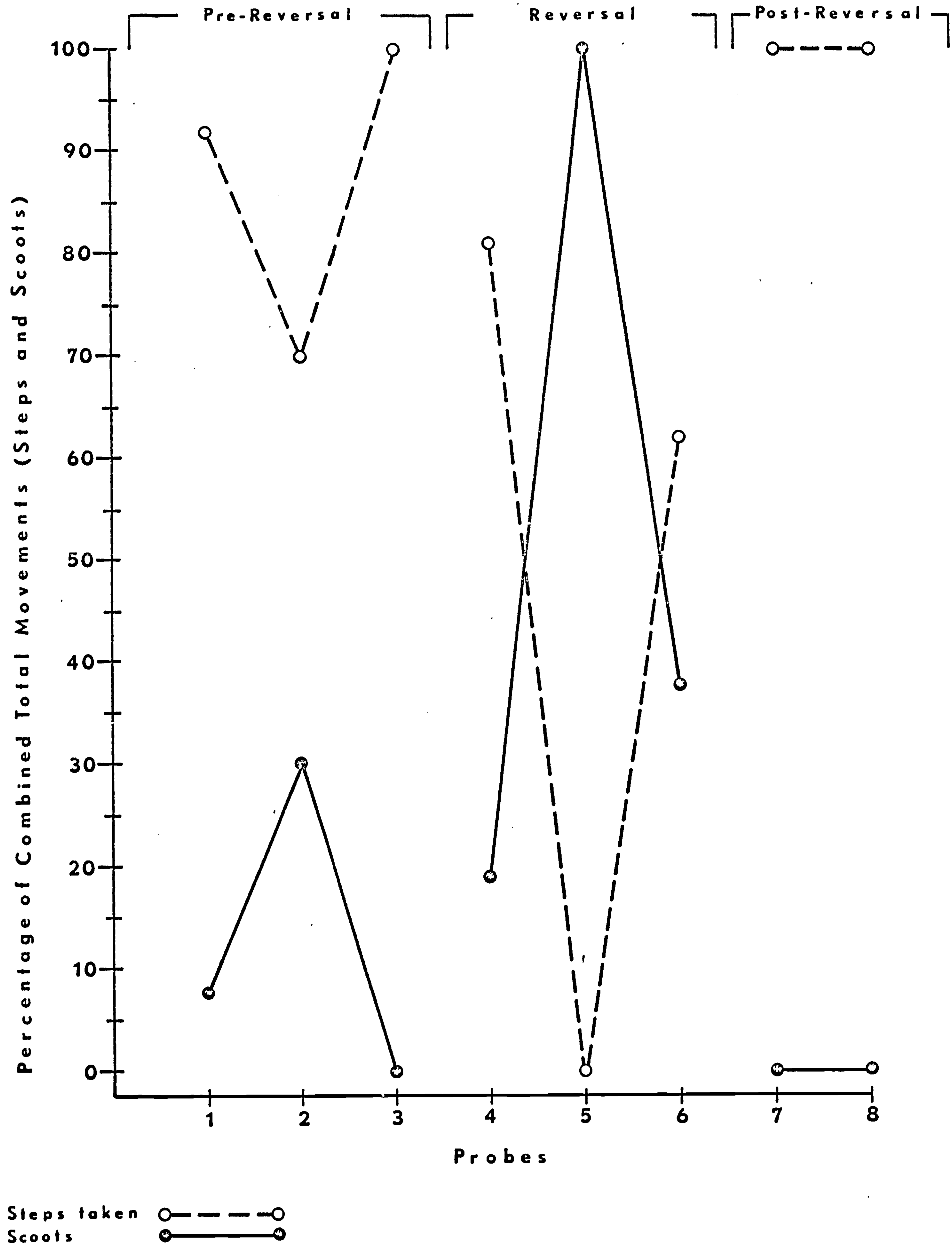


Fig. 3



Pre-Reversal
Reversal
Post-Reversal
100
90
80
70
60
50
40
30
20
10
0
Percentage of Combined Total Movements (Steps and Scoots)
1
2
3
4
5
6
7
8
Probes
Steps taken
Scoots

Fig.4 - Sitting

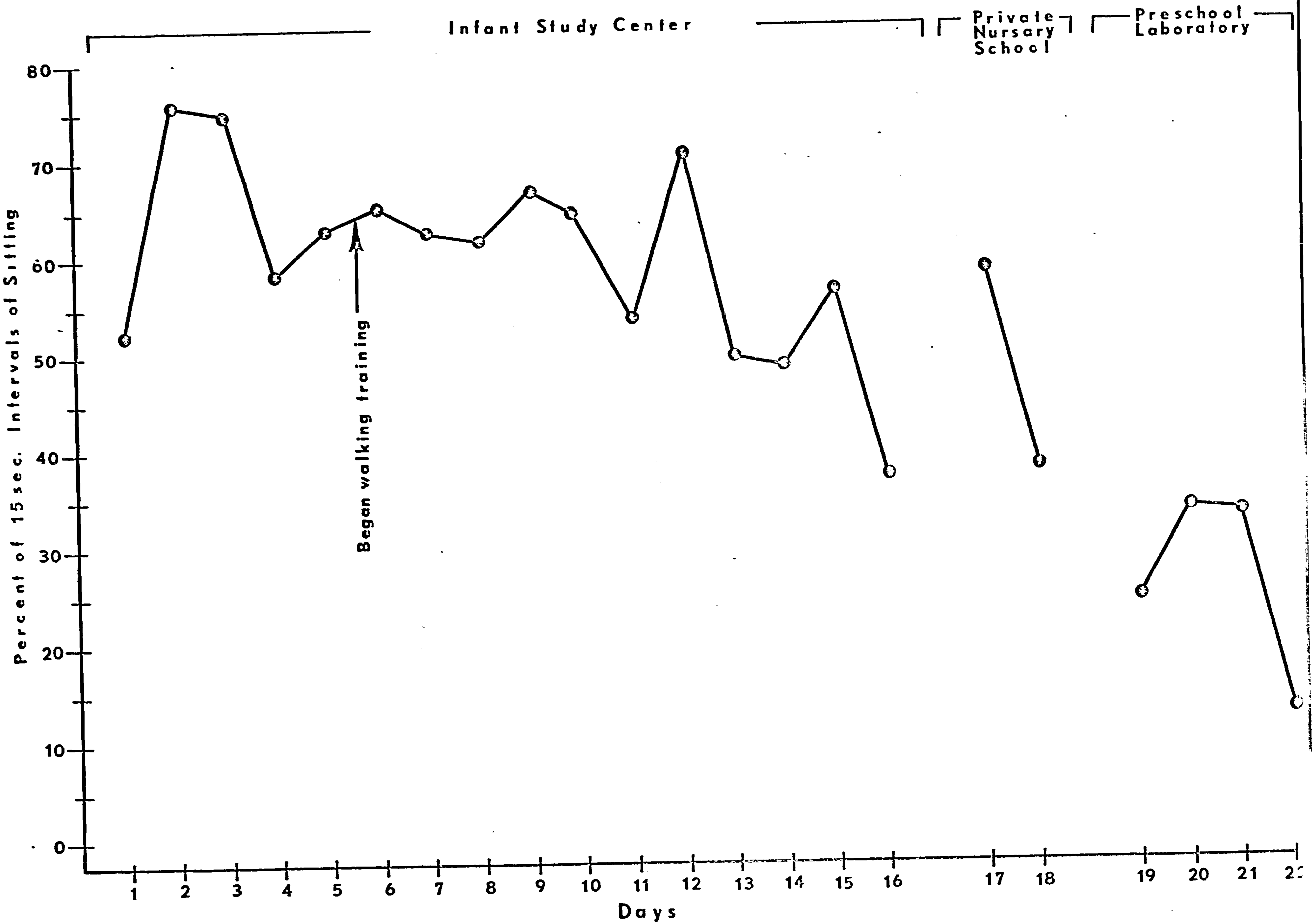


Fig. 5 Scooting

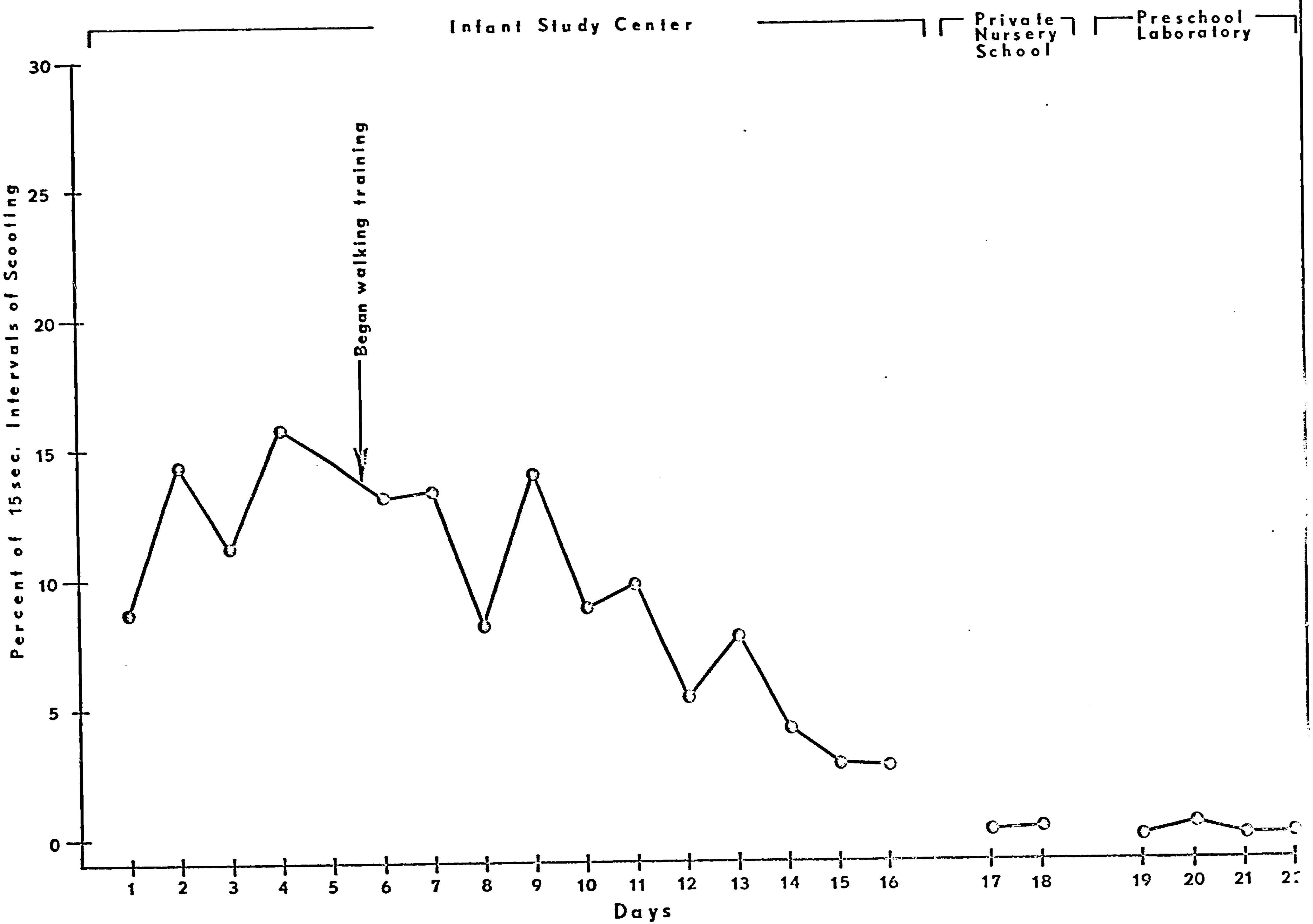
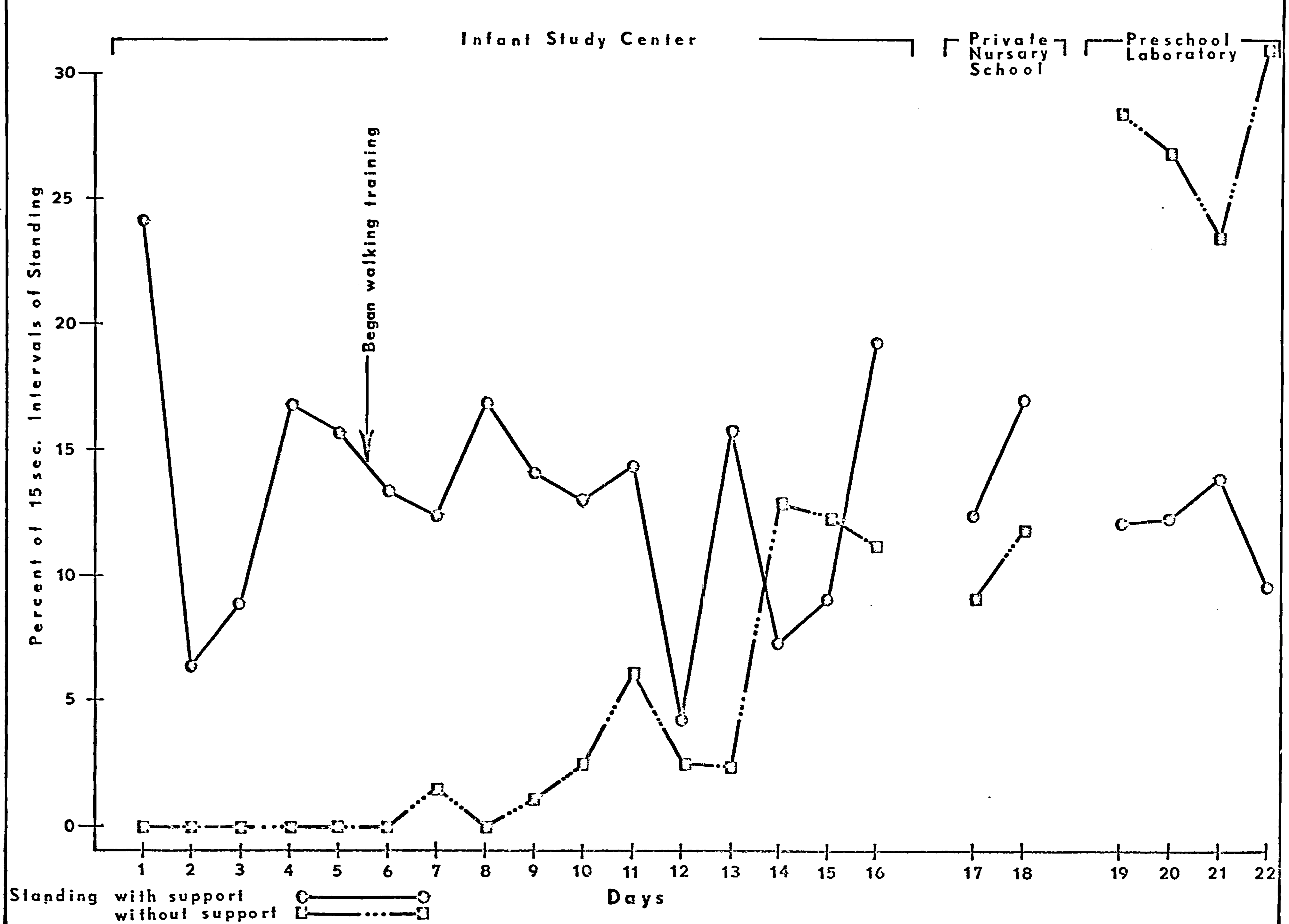


Fig.6 - Standing With and Without Support



g.7 -Getting Up From Floor With and Without Support

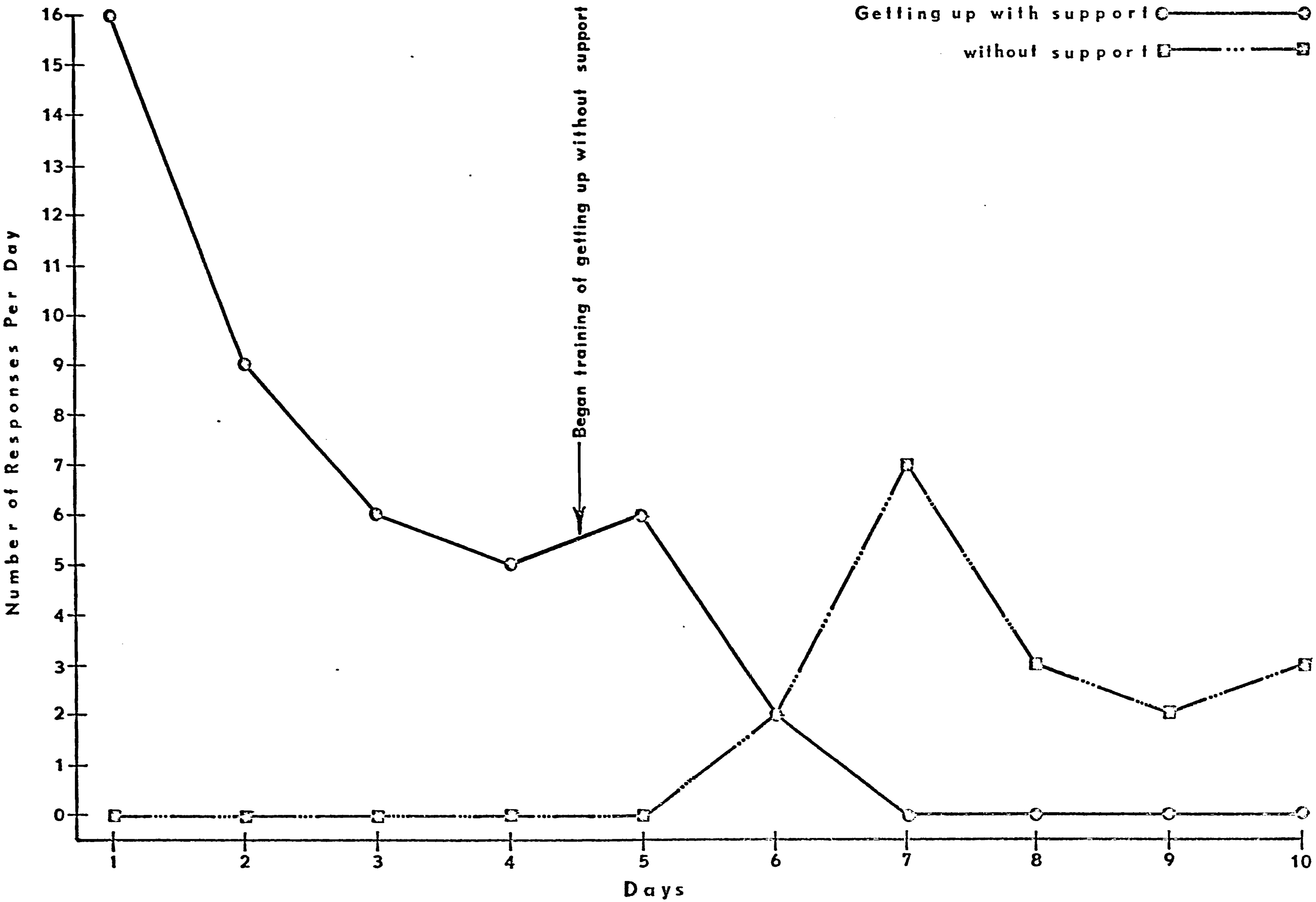
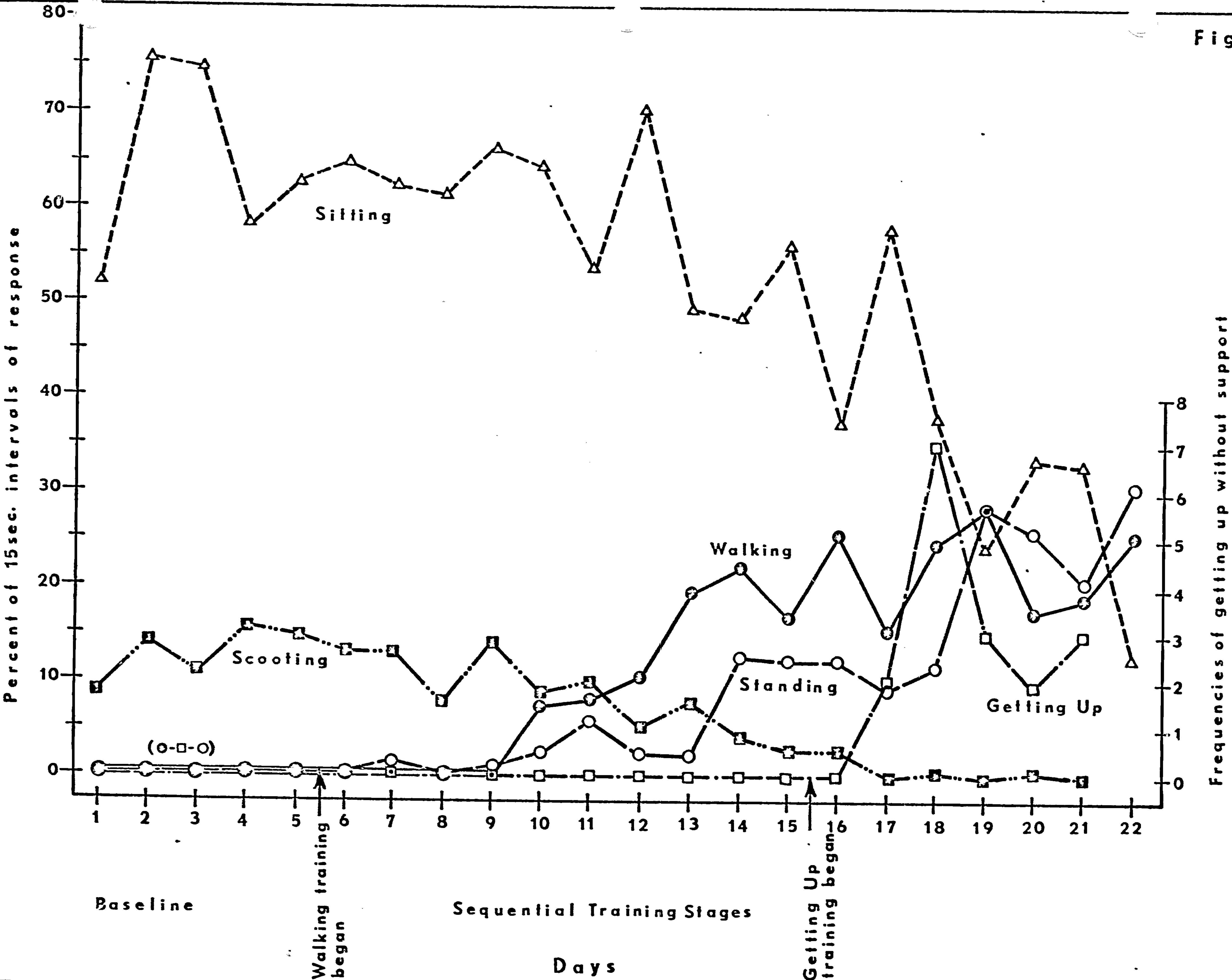


Fig. 8


Percent of 15sec. intervals of response
80
70
60
50
40
30
20
10
0
Sitting
Scooting
Walking
Standing
Getting Up
(o-□-o)
Frequencies of getting up without support
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
Baseline
Walking training began
Sequential Training Stages
Getting Up training began
Days