The use of operant procedures to develop ambulation in a wheelchair confined male

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The Use of Operant Procedures to Develop Ambulation in a Wheelchair Confined Male

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the Graduate Faculty

of the

University of the Pacific

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of The Requirements of the Degree

Master of Arts

Burton E. Shook

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This thesis, written and submitted by

Burton E. Smith

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on Graduate Studies, University of the Pacific.

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Dated May 2, 1977
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In Memory of

BURTON E. SHOOK III
Abstract

Studies have shown that operant procedures can be successfully used in physical rehabilitation. This study was an attempt to develop standing and walking behaviors in a 47-year old male who was confined to a wheelchair. A multiple baseline design across settings was used to demonstrate the effects of verbal, physical and edible reinforcers on three sub-behaviors of standing. The first two sub-behaviors were trained and training had begun on the third sub-behavior when the study was abruptly terminated. Thus, no training sessions for walking took place.
Fuller (cited in Ulrich, Stachnik, & Mabry, 1966) reported as early as 1949 the successful use of operant conditioning to teach an arm raising response to a "vegetative human organism". Although this could be considered a physical rehabilitation attempt of sorts, Fuller did not direct himself to this point.

The potential for the use of learning principles in physical rehabilitation was first directly addressed by Meyerson, L., Michael, J. L., Mowrer, M. O., Osgood, C.E. & Staats, A. W. (1963). The authors stated what learning theory could offer the field of physical rehabilitation: "If the learning group has anything to offer to the field of rehabilitation, it is a strong statement that behavior is a function of environmental variables which can be manipulated and utilized. The laymen's view that behavior is internally controlled and mediated by verbalized understanding is probably badly in need of correction or supplementation" (p. 75).

They continued on to point out where the problems lie and what the deficits that lead to these problems are. "Many problems in rehabilitation seem to stem from attempts to change people's behavior by telling or explaining something to them rather than altering the reinforcing environment. If the person doesn't understand, it is thought that the behavior can't be changed. If he does understand, then he should do what is
requested of him, and therapists are puzzled when the appropriate behavior is not forthcoming. They appear not to know that many complex performances can be accomplished by people who may not understand what they are doing in the sense of being able to verbalize those performances or the reasons for their own behavior. Needless failure in rehabilitation occurs when a person is said to be too unmotivated, too stupid, too stubborn, or too psychotic to behave in a desired way. Many behavioral deficits are not under obvious control, and many cannot be controlled verbally" (p. 75).

It appears then that the problems encountered in rehabilitation have, in part, been the result of a lack of knowledge concerning the control that certain environmental stimuli have on behaviors and lack of knowledge concerning the manipulation of these environmental stimuli for the purposes of behavior change.

In recent years though, behavioral techniques have been used more and more in rehabilitation, particularly with ambulation or walking (Bank, 1968; Deibert & Harmon, 1973; Herson, Matherne, Gullick & Harbert, 1972; Horner, 1971; Loynd & Barclay, 1970; MacDonald & Butler, 1974; Meyerson, Kerr & Michael, 1967; and O'Brien, Azrin & Bugle, 1972). The techniques used have included reinforcement (verbal praise) plus instructions (Herson et al., 1972); fading of modelled and physical prompts, and natural reinforcers (those that are readily available in the
immediate environment) (Horner, 1971); and social reinforcement (MacDonald & Butler, 1974).

Meyerson et al. (1963) listed and defined three terms:

"...habilitation; original learning prior to the interference we call disability; ...dishabilitation; learning to be disabled; ...rehabilitation; learning to be better" (p. 82). In considering Meyerson et al.'s. definition of dishabilitation, learning to be disabled, it follows that certain environmental situations lead, if not to the development of so-called disabilities, than at least to the prolongation of them. In the studies which deal with ambulation, this can be clearly seen (Bank, 1968; Deibert & Harmon, 1973; Herson, et al., 1972; Loynd & Barclay, 1970; MacDonald & Butler, 1974; Meyerson et al., 1967; and O'Brien, et al., 1972). With regards to ambulation, this dishabilitation occurs in home environments (Bank, 1968; Herson, et al., 1972; Loynd & Barclay, 1970), as well as institutional environments (MacDonald & Butler, 1974; Meyerson et al., 1967; O'Brien et al., 1972).

It appears that in the home environments where ambulation does not occur, the original problems are either physical or developmental and that this creates a behavior pattern in the rest of the family which in turn reinforces the disability (Bank, 1968; Deibert & Harmon, 1973; Loynd & Barclay, 1970).
Bank (1968) described a situation in which a child developed normally until age 1 when he had difficulty gaining weight. With regards to motor development, he sat alone at 12 months, but did not develop any of the other steps leading to walking and spent most of his time "scooting" around. Bank (1968) stated, "He was regarded as the 'pet' of the family. Few demands were made of him, he was pampered and got his way with nearly everything. The parents felt that it was 'hopeless' to try to get him to walk because he seemed so helpless and enjoyed scooting so well" (p. 150). It appears that "not ambulating" was, in this case, being reinforced.

In institutions, many different situations result in non-development of ambulation. MacDonald and Butler (1974) stated that "mere residence in an institution for the aged can have deleterious effects, including the unintended encouragement of physical deterioration" (p. 97). The authors said that in environments such as these, "helplessness" is reinforced. It is expected and encouraged for "nursing home residents to fulfill the 'sick role' as their social role" (p. 97).

Other studies indicated that there is not only considerable inconsistency in the reinforcement of patient behaviors, but that patients are shaped, through mismanagement of behavioral contingencies, to remain in a disabled condition (Bank, 1968;
In some of these cases, reinforcement occurs whether there is any progress in physical rehabilitation or not.

Meyerson et al. (1967), discussed the institutional situation where the individual receives a certain label or is the recipient of an experience, with the result that because of the label or experience, the nursing staff take on the attitude that the individual is incapable of certain responses. They stated that "diagnosis of mental retardation, however, which by definition is an 'incurable' disorder, tends to lead to the easy acceptance of the inevitability of behavioral deviance and behavioral deficits and to choke off some simple rearrangements of the environment which might lead to the generation of more adequate behavior" (p. 225).

The circumstances of the present study exemplified this situation. The subject was suspected of having experienced a cerebral vascular accident and for the year and a half preceding the study was confined to a wheelchair. Few attempts had been made to physically rehabilitate him because it was determined that he was not capable of walking.

As was the case with previously mentioned studies, it appeared that the subject received adequate attention in his
present state, that most of his demands were met, and that he was apparently content. According to the information obtained from the notes in his hospital chart, when physical rehabilitation attempts had been made by the ward physical therapist or psychiatric technicians, his angry behavior quickly quelled these attempts, thus insuring more strongly his confinement to a wheelchair.

In the present study an attempt was made to develop ambulation in the subject using behavioral techniques, specifically: modeling, instructions, physical guidance, and social, physical and edible reinforcement.
Method

Subject

Felipe (a pseudonym), a 47 year old institutionalized Mexican male, served as the subject in this study.

Felipe had been intermittently institutionalized for the past 12 years for numerous reasons including alcoholism, "schizoid personality", and aggressive behavior. Seven months prior to the study he was institutionalized at a state hospital because of his episodes of aggressive behaviors at a convalescent hospital. At the time this study began he had been transferred to a locked convalescent facility with a diagnosis of pre-senile dementia.

Felipe was selected for this study because of his history of failure to walk following hospitalization. The exact etiology of this problem was unknown although his records indicate the possibility of a cerebral vascular accident. He was, as of a year and a half before this study, "ambulatory with assistance", but his walking had declined to the point where his only method of locomotion was a wheelchair.

Medical examinations revealed severe atrophy of the leg muscles, and an intensive X-ray examination of the cortex (an EMI scan), indicated some cortical atrophy but was interpreted by a neurologist as being non-significant and unrelated to any failure to walk.
Settings and Equipment

The study took place in two different settings in a building situated on the grounds of a state hospital. The first setting (A) was located in a large vacant room, formerly used as a dormitory. The setting was an isolated cubical, one of eight in the room, which measured 5.4m by 5.44m. It was well lit and clear of all objects save the experimental equipment.

The second setting (B) was an open area of an unused room containing bath and shower facilities. The area measured 4.17m by 4.92m. It was well lit and clear of all objects save the experimental equipment.

The equipment used in this study consisted of two identical wheelchairs and an upright steel pole secured to a round base. One wheelchair was used by the subject during experimental sessions in the settings. The other wheelchair was used in each setting, by the experimenter, to model the sub-behaviors. Each chair had a single black line painted on the seat, 19cm from the back of the chair. The brakes on the subject's wheelchair were set, and two pieces of wood were placed in the spokes of the wheels so that forward and backward movement was prevented.

The steel pole (1.54m high) stood to the side of and 26cm in front of the edge of the subject's seat.
**Response Definition**

Two separate behaviors were to be developed in this study, standing and walking.

**Standing.** The response of standing was broken down into three sub-behaviors, two of which were taught, and the third which was to be taught. The three sub-behaviors were:

1. Grasping the arms of the wheelchair and sliding the torso to the edge of the wheelchair.
2. Leaning forward in the chair.
3. Pushing off the chair and standing up.

For the purposes of this study, these more specific definitions of the three sub-behaviors were utilized:

sub-behavior 1, grasping the arms of the wheelchair and sliding the torso towards the edge of the wheelchair until the black line on the seat is visible directly behind the subject.

sub-behavior 2, leaning forward in the chair until the subject's head is at or beyond the plane of the steel pole.

sub-behavior 3, pushing off the chair with the hands, standing up and releasing the arms of the chair.

Therefore, standing was defined as the following; from a seated position where the legs are bent and are in front of the torso, grasping the arms of the wheelchair and sliding the torso
towards the edge of the wheelchair until the black line on the seat is visible directly behind the subject, leaning forward in the chair until the subject's head is at or beyond the plane of the steel pole, pushing off the chair with the hands, standing up and releasing the arms of the chair and being in a position, unsupported by a person or some physical object, where the legs are straighter and are under the torso.

Walking. Schurr (1967), defined walking in the following manner: "A natural walk is a movement which carries the body through space by a transference of weight from one foot to another. The movement is initiated with a push-off diagonally backward against the ground with the ball and toes of one foot. After the push-off is made, the leg swings forward as flexion is initiated at the hip joint, then the knee and the ankle lift the foot clear off the floor. The weight is transferred from the heel along the outer edge of the foot to the ball and to the toes as the next push-off is made. The feet point straight ahead and the inner borders fall along a straight line. As the arms swing freely and in opposition to the legs, they counterbalance the rotation of the trunk and help carry the upper part of the body forward. There is a brief period of time when both feet are in contact with the floor and a new base of support is established. The position of the body should be erect and easy".

Another source, Souder and Hill (1963), defined walking basically the same way as Schurr. While the definitions given in these two sources are sound ones, certain considerations in this study necessitated their modification.'
The subject in this study displayed extreme atrophy and a loss of fine and gross motor movements in his legs. Shaping up gross movements and strengthening leg muscles was expected to be difficult enough without the addition of working on fine movements. It was expected that the time taken to work on the former would be considerable and that success here would be a great accomplishment in itself.

Walking therefore, was defined as forward locomotion in a standing posture, each foot alternately moving ahead of the other, by at least 5.1cm, with the soles and heels of the feet being the only part of the body touching the ground. The foot which was moving ahead did not necessarily have to leave the ground, therefore, a shuffling effect was not only possible but would have been acceptable.

Response Recording

In this study, the experimenter acted as his own observer. Standing. In each trial, for every sub-behavior the subject was instructed to perform, the experimenter recorded four types of data on the data sheet (see Appendix 1): (a) whether the subject's response was correct or incorrect, (b) whether or not the experimenter gave the subject a physical prompt, (c) whether or not the experimenter gave the subject a verbal prompt, (d) whether or not
or not reinforcement was delivered. If a response was correct, the experimenter placed a "C" in the appropriate trial/sub-behavior box contained in the column labeled "C/I", and if the response was incorrect an "I" was marked. When the experimenter gave the subject a physical prompt, a "P" was marked in the appropriate trial/sub-behavior box contained in the column labeled "Prompts", and when a verbal prompt was given the subject, a "V" was marked. If no prompts were given an "O" was recorded. When reinforcement was delivered the experimenter placed a check (✓) in the appropriate trial/sub-behavior box contained in the column labeled "Sr+". An "O" was marked if no reinforcement was delivered.

Reliability measures of each sub-behavior were recorded at least once in each condition of each setting with the exception of the treatment condition for sub-behavior 3, in setting A, and the treatment condition for sub-behavior 2, in setting B. In these two instances the study was abruptly terminated before reliability could be recorded. Table 1 lists the number of reliability sessions recorded for each sub-behavior in each condition and setting.

During the reliability sessions, a second observer recorded, in each trial and for every sub-behavior, the four types of data previously mentioned. The data sheets of the experimenter
Table 1
Number of Reliability Sessions & Average Reliability Scores

<table>
<thead>
<tr>
<th>Sub-behavior #, Condition &amp; Setting</th>
<th># of Reliability Sessions</th>
<th>Average Reliability Scores</th>
</tr>
</thead>
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<tr>
<td>sub-behavior 1 baseline setting A</td>
<td>2</td>
<td>100% C/I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100% physical prompts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100% verbal prompts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100% Sr+</td>
</tr>
<tr>
<td>sub-behavior 1 treatment setting A</td>
<td>2</td>
<td>100% C/I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100% physical prompts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>96.5% verbal prompts</td>
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<td></td>
<td></td>
<td>100% Sr+</td>
</tr>
<tr>
<td>sub-behavior 2 baseline setting A</td>
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<td>100% C/I</td>
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<td>100% verbal prompts</td>
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<td></td>
<td>100% Sr+</td>
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<td>100% physical prompts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100% verbal prompts</td>
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<td></td>
<td>100% Sr+</td>
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<tr>
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<td>100% C/I</td>
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<td>100% physical prompts</td>
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<td></td>
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<td>100% verbal prompts</td>
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<tr>
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<td></td>
<td>100% Sr+</td>
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<td>100% C/I</td>
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<tr>
<td></td>
<td></td>
<td>100% physical prompts</td>
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<tr>
<td></td>
<td></td>
<td>100% verbal prompts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100% Sr+</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>100% physical prompts</td>
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<tr>
<td></td>
<td></td>
<td>100% verbal prompts</td>
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<tr>
<td></td>
<td></td>
<td>100% Sr+</td>
</tr>
<tr>
<td>sub-behavior 1 treatment setting B</td>
<td>1</td>
<td>100% C/I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100% physical prompts</td>
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<tr>
<td></td>
<td></td>
<td>100% verbal prompts</td>
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<tr>
<td></td>
<td></td>
<td>100% Sr+</td>
</tr>
<tr>
<td>sub-behavior 2 baseline setting B</td>
<td>3</td>
<td>86.7% C/I</td>
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<td></td>
<td></td>
<td>100% physical prompts</td>
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<td>100% verbal prompts</td>
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<tr>
<td></td>
<td></td>
<td>100% Sr+</td>
</tr>
<tr>
<td>sub-behavior 3 baseline setting B</td>
<td>3</td>
<td>100% C/I</td>
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<td></td>
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<td>100% physical prompts</td>
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<td></td>
<td></td>
<td>100% Sr+</td>
</tr>
<tr>
<td>sub-behavior 2 treatment setting B</td>
<td>0</td>
<td>100% C/I</td>
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<td>100% physical prompts</td>
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<td>100% verbal prompts</td>
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<tr>
<td></td>
<td></td>
<td>100% Sr+</td>
</tr>
</tbody>
</table>
and the second observer were compared, and reliability was calculated by dividing the number of agreements between the two observers by the number of agreements plus disagreements, and multiplying that quotient by 100. Table 1 lists the mean reliability scores of the four types of data, for each sub-behavior in each condition and setting. It can be seen that the mean reliability score was 100% in all but two instances. The mean reliability score for verbal prompts during the treatment phase of sub-behavior 1, in setting A, was 96.5% and the mean reliability score for C/I responses during the baseline phase of sub-behavior 2, in setting B, was 86.7%.

Walking. Walking was to be recorded as follows: the experimenter was to count each step the subject took after the command, "Walk _______ steps Felipe", was given, and was to record the sum on a scoresheet at the end of each trial. A new count was to begin at the start of each trial. Reliability was to be taken twice in the baseline condition of each setting and at least once in the treatment condition of each setting. Reliability was to be taken in a manner similar to that as described in the Standing section with the following differences; the response would be number of steps per trial and an agreement between observers would consist of the same amount of steps counted, per trial, by each observer.
Design

Two designs were to be used in this study. The primary design was to be that of a multiple baseline (Baer, Wolf, & Risley, 1968) across two settings. For standing, this design was used and consisted of the following conditions: baseline periods of observation for each setting A and B, the sequential introduction of treatment phases for the sub-behaviors in setting A while the baseline conditions for the respective sub-behaviors in setting B are maintained, and the introduction of treatment in setting B.

The criterion for termination of the baseline phases for sub-behaviors 1 and 2 in setting A, was, when after a few sessions there was zero correct responses or no increase in correct responses.

The original criterion for termination of the treatment phases for sub-behaviors 1, 2, and 3 in setting A, was 15 unprompted correct consecutive trials. This criterion was changed for sub-behavior 1 because it was determined to be too stringent.

For walking, the multiple baseline design was to have consisted of the following conditions: a baseline period of observation for each setting A and B, the introduction of treatment in setting A while the baseline condition is maintained in setting B,
and the introduction of treatment in setting B.

A changing criterion design (Hall, 1971; and Hartmann & Hall, 1976) was to have been incorporated within the multiple baseline design for walking. This design was to have included the same baseline period of observation as the multiple baseline design plus, the addition of a changing criterion condition. The changing criterion condition would have consisted of the experimental contingency whereby the level of performance, in this case, the number of steps walked, required to earn reinforcement, increased as performance improved. This condition would have applied during the treatment phases of the multiple baseline design for walking.

Procedure

Reinforcement package. In all the treatment phases for the three sub-behaviors, reinforcement consisted of the following for each correct response: one tablespoon of vanilla ice-cream, verbal praise ("good Felipe," "very good," "very fine," or "excellent", see Appendix 2), tactile stimulation in the form of pats on the back and rubbing the shoulder areas, and all delivered by a female student. At the end of the session, if the subject had responded correctly in eight or more trials, he was given a cigarette. The tangible reinforcers were in full view of the subject at all times during treatment conditions.
Baseline: Sub-behavior 1; settings A and B. During the baseline phase for sub-behavior 1, in each setting, the subject was wheeled to the experimental area. The experimenter then placed the subject in the experimental wheelchair, making sure the subject sat in the back of the wheelchair seat. The experimenter then instructed the subject, in Spanish (it was determined that the subject seemed to understand Spanish better than English, therefore all verbal instructions, verbal prompts etc. given to the subject, were spoken in Spanish. see Appendix 2), to perform sub-behavior 1, "Felipe, grasp the arms of the wheelchair and slide to the edge of the wheelchair seat." The subject was given 15 seconds to begin responding to the instruction. After 15 seconds, regardless of whether the subject failed to respond or was responding incorrectly, the procedure, beginning with the instruction, was repeated. A trial began with the experimenter's instruction to perform sub-behavior 1 and ended when, after 15 seconds, the subject had failed to respond, or was responding incorrectly. After each trial the experimenter recorded the results of the trial on the data sheet and made sure the subject was in the back of the seat for the beginning of the next trial. There were 15 trials per session in each setting. One session per setting took place each day, thus,
There were two sessions per day, one in the morning and one in the afternoon. In order to minimize the effects of the time of day on any results, the times of the sessions were alternated between settings each day. For example, a session in setting A would take place in the morning one day, in the afternoon the next day etc. The times for setting B were opposite that of setting A. This situation prevailed in every phase of both settings.

The baseline phase for sub-behavior 1, setting A, was terminated after 8 sessions of no correct responses (see Figure 1, hereafter, to avoid confusion, it may help the reader to refer to Figure 1 whenever the initiation or termination of a particular phase in a particular setting is being explained).

The baseline phase for sub-behavior 1, setting B, was terminated when the criterion for termination of the treatment phase of sub-behavior 1, setting A was met.

Baseline: Sub-behaviors 2 and 3; settings A and B. The baseline phase for sub-behaviors 2 and 3 began in setting A after the criterion for termination of the treatment phase in setting A, sub-behavior 1, was met. The baseline phase for sub-behaviors 2 and 3 began in setting B after the criterion for termination of the baseline phase in setting A, sub-behavior 2, was met.
Fig. 1. Design for sub-behaviors 1, 2 and 3.
The baseline procedure for sub-behaviors 2 and 3 was the same in both settings. After the subject had been placed in the experimental wheelchair he was instructed to perform sub-behavior 1. If he complied he was given the reinforcement package, if he didn't comply he was prompted until he did and then given the reinforcement package. Then the experimenter instructed the subject to perform sub-behavior 2, "Lean forward in the chair." The subject was given 15 seconds to respond to the instruction. After 15 seconds had elapsed, regardless of whether or not the subject correctly responded, the experimenter gave the instruction for sub-behavior 3, "Push off the chair and stand up", and another 15 seconds was allowed for compliance. After that 15 seconds, regardless of whether the subject failed to respond or was responding incorrectly, the trial was over. A trial began with the experimenter's instruction to perform sub-behavior 1 and ended 15 seconds after the instruction for sub-behavior 3 had been given. After each trial the experimenter recorded the results on the data sheet and pushed the subject to the back of the wheelchair seat in preparation for the next trial.

The baseline phase for sub-behavior 2, setting A, terminated after 4 sessions of no correct responses.
The baseline phase for sub-behavior 3, setting A, terminated when the criterion for termination of the treatment phase of sub-behavior 2, setting A was met. In other words, the baseline phase of sub-behavior 3, setting A continued during the treatment phase for sub-behavior 2, setting A.

The baseline phase for sub-behavior 2, setting B was terminated when the treatment phase of sub-behavior 2, setting A, was met.

The baseline phase for sub-behavior 3, setting B was still in effect when the study was terminated.

Treatment: Sub-behavior 1, settings A and B. The treatment phase for sub-behavior 1, setting A began when the baseline phase for sub-behavior 1, setting A was terminated.

The treatment phase for sub-behavior 1, setting B began when the termination of treatment phase for sub-behavior 1, setting B occurred.

The treatment procedure for sub-behavior 1, in both settings A and B, was the same. The subject was first placed in the experimental wheelchair. To begin the trial, the experimenter modeled sub-behavior 1. Next, he gave the subject the instruction to perform sub-behavior 1, "Grasp with your hands the ends of the arms of the wheelchair and slide to the edge of the wheelchair seat." The subject was given 15 seconds to begin
responding correctly. If, after 15 seconds, the subject was responding correctly, he was allowed to continue until a correct response was completed or until he stopped responding for 7 seconds. If the subject made a correct response he was immediately reinforced.

If, 15 seconds after the instruction was given, the subject had not begun responding or was responding incorrectly the experimenter used either physical prompts, verbal prompts, or in some trials both, in an attempt to elicit a correct response (except in trials where the prompts had been faded). A physical prompt was any touching of the subject by the experimenter during the trial. For example, the experimenter would grasp the subject by the legs and pull him forward in the seat, or put a hand on the subject's lower back and push, or if the subject wasn't grasping the arms of the wheelchair, the experimenter would place the subject's hands on them. A verbal prompt was anything the experimenter would say, or any gestures the experimenter would make, to the subject, after the instruction to perform the sub-behavior was given. For example, if the subject had slid forward in the chair, but not enough for a correct response the experimenter would tell him, "more Felipe", would gesture with his hand to induce the subject to continue moving forward, or if the subject was not holding
the arms of the wheelchair the experimenter would either tell him to or would touch the arms of the chair to indicate to the subject what he should be grasping. The experimenter faded the physical and verbal prompts by decreasing their use in succeeding trials.

If the subject correctly responded after prompts were given, he was immediately reinforced. Thus, a trial began with the experimenter modeling the response and ended when either the subject was reinforced, or when he didn't respond at all.

At the end of each trial the experimenter recorded the results and pushed the subject to the back of the chair seat in preparation for the next trial.

The treatment phase for sub-behavior 1, setting A, was terminated after the subject averaged 67% correct responses per trial over the last four consecutive unprompted sessions.

The treatment phase for sub-behavior 1, setting B, was terminated when the baseline phase for sub-behavior 2, setting B, was initiated.

Treatment: Sub-behavior 2, settings A and B. The treatment phase for sub-behavior 2, setting A, began upon termination of the baseline phase for sub-behavior 2, setting A. The treatment phase for sub-behavior 2, setting B, began upon termination of treatment phase of sub-behavior 2, setting A.
The treatment procedures for sub-behavior 2 were the same in both settings.

The subject was placed in the experimental wheelchair and instructed to engage in sub-behavior 1. If the subject did not comply on his own he was prompted until he did. After the subject complied, the experimenter then modeled sub-behavior 2 and instructed the subject to perform sub-behavior 2, "Lean forward in the chair". The subject was then given 15 seconds to respond to the instruction. If the subject correctly responded within 15 seconds, he was immediately reinforced. If the subject did not respond correctly within 15 seconds, the experimenter used either physical prompts, verbal prompts, or both in an attempt to elicit a correct response (except in trials where the prompts had been faded). A physical prompt in this case consisted of the experimenter pushing down and forward lightly on the subject's upper back and head. A verbal prompt consisted of the experimenter telling the subject "more" or "lean more". If the subject responded correctly after prompts were given he was immediately reinforced.

Because the baseline condition for sub-behavior 3 continued during treatment condition for sub-behavior 2 in both settings, after the subject received reinforcement for a correct response for sub-behavior 2 (prompted or unprompted) or responded
incorrectly in an unprompted trial, the experimenter instructed the subject to perform sub-behavior 3. The subject was given 15 seconds to comply, after which time the trial was over. Thus a trial began with an instruction to the subject to perform sub-behavior 1 and ended 15 seconds after the subject was instructed to perform sub-behavior 3.

The treatment phase for sub-behavior 2, setting A, was terminated when, in session 2, the subject met the criterion of 15 consecutive correct trials. The treatment phase for sub-behavior 2, setting B, was terminated after 2 sessions when the study was halted.

**Treatment: Sub-behavior 3, setting A.** The treatment phase for sub-behavior 3, setting A, began upon termination of the treatment phase for sub-behavior 2, setting A.

The subject was placed in the experimental wheelchair and instructed to perform sub-behavior 1. If necessary he was prompted until he complied. He was then instructed to perform sub-behavior 2, and again when necessary prompts were used to elicit a correct response. The experimenter then modeled sub-behavior 3 and instructed the subject to perform sub-behavior 3, "Push off with the hands and stand up." The subject was allowed 15 seconds to respond correctly.
When after 15 seconds the subject did not respond or when the subject immediately started responding incorrectly, the experimenter physically prompted the subject. A physical prompt in this case required the experimenter to place his hands under the subject's arms, from behind, and help lift the subject to a standing position. The subject could not support himself in that position, therefore it was necessary for the experimenter to continue holding the subject. Verbal prompts consisted of telling the subject, "Let go of the chair", once he was in a standing position. After the subject was in a standing position and had released the wheelchair he was immediately reinforced. A trial began when the subject was instructed to perform sub-behavior 1 and ended with either an incorrect sub-behavior 3 response or reinforcement for a correct sub-behavior 3 response. The treatment phase for sub-behavior 3, setting A, ended after 3 sessions.

At the conclusion of each session in this study the subject was given the instruction, "Felipe, stand up and walk forward." The main purpose for the instruction was to provide a session to session check that would test whether the training of the sub-behaviors was necessary for this subject.

In an incident unrelated to the study, the subject sustained a broken hip, thus the study was halted prematurely.
Probe Sessions. During the study, eight probe sessions were conducted at the convalescent hospital where the subject lived. The sessions took place in the subject's bedroom where, the experimenter had previously observed, the subject spent much of his time. During the probe sessions, the subject was instructed to perform one or more of the sub-behaviors depending on the condition in effect in setting A. For example, when the baseline or treatment conditions for sub-behavior 1, setting A, were in effect, a probe session trial consisted only of the instruction to perform sub-behavior 1. When the baseline condition for sub-behaviors 2 and 3 or the treatment condition for sub-behavior 2 was in effect, the experimenter instructed the subject to perform sub-behavior 1, sub-behavior 2, and sub-behavior 3.

There were 10 trials per probe session, 5 less than the experimental sessions. The reason for this was that the subject was extremely more aggressive and agitated in his "home" environment than in the experimental settings, so for the convenience of all concerned, a reduction in trials was made.
Results

Sub-behavior 1, setting A. Figure 2 presents the percentage of correct responses, physical prompts, and verbal prompts, per session, for sub-behavior 1, in setting A, across all experimental conditions.

During the baseline phase the subject did not respond correctly in any of the sessions, thus the mean percentage for the eight baseline sessions was 0.

As the graph for sub-behavior 1, setting A, in Figure 2 indicates, the initiation of physical prompts, verbal prompts, and reinforcement, at session 9, rapidly increased the percentage of correct responses of the subject. This increase continued even though the frequency of the physical prompts was quickly reduced. The mean percentage of correct responses per session, for the sessions in which both physical and verbal prompts as well as reinforcement were used (9, 10, 11, 14), was 82. This is an 82% increase over baseline levels. The graph for sub-behavior 1, setting A, in Figure 2, indicates that as the verbal prompts were being faded, there was a decrease in correct responding, but the mean still remained much higher than baseline levels. The mean percentage of correct responses per session, for the sessions in which only verbal prompts were used in conjunction with reinforcement (12, 13, 15019), was 72.
Fig. 2. Average percentage of correct responses, physical prompts, and verbal prompts per session, across all conditions in two different settings, for sub-behaviors 1, 2, and 3, and average percentage of correct responses per probe session in the probe setting.
This represents a 72% increase over baseline levels. The graph for sub-behavior 1, setting A, in Figure 2, indicates that in the sessions after both physical and verbal prompts had been completely faded (20, 21, 22, 23), the percentage of correct responses decreased slightly but remained far above baseline levels. The mean percentage of correct responses per session, for the sessions in which no prompts were used in conjunction with reinforcement, was 67. This is a 67% increase over baseline levels. The same graph in Figure 2 indicates that a resumption of the use of verbal prompts for sub-behavior 1, during the baseline phase for sub-behaviors 2 and 3, setting A, resulted in a tremendous increase in correct responding by the subject, of sub-behavior 1. The mean percentage of correct responses per session for the four sessions of this phase was 97. The mean percentage of verbal prompts per session for sub-behavior 1 was 73. It can be seen that during the treatment phase for sub-behavior 2, setting A, the continued use of verbal prompts resulted in a mean percentage of correct responses per session of 100 for sub-behavior 1. The mean percentage of verbal prompts per session for sub-behavior 1 was 90.

As the graph for sub-behavior 1, setting A, in Figure 2 indicates, 100% correct responses per session for sub-behavior 1,
continued during the three treatment sessions for sub-behavior 3.
The mean percentage of verbal prompts per session for sub-behavior 1 was 93.

Sub-behavior 1, setting B. The graph for sub-behavior 1, setting B, in Figure 2 presents the percentage of correct responses, physical prompts and verbal prompts, per session, for sub-behavior 1, setting B, across all the experimental conditions.

During the baseline phase the subject did not respond correctly in any of the sessions. Thus the mean percentage for the 24 baseline sessions was 0. Sessions 9 through 24 were conducted while the treatment phase for sub-behavior 1, setting A, was in effect.

As the graph for sub-behavior 1, setting B, in Figure 2 presents, the introduction of reinforcement and the inadvertant use of verbal prompts in the first session (25) of the treatment phase for sub-behavior 1, setting B, resulted in a large increase in the percentage of correct responses. The first session was the only one during this condition in which prompts were used. It can be seen that the high rate of correct responding continued during this phase, with the exception of the third session (27). The mean percentage of correct responses per session for sub-behavior 1 during this phase was 65. The mean percentage of verbal prompts per session was 3, with all
the prompts occurring during the first session.

The graph for sub-behavior 1, setting B, in Figure 2 indicates that the introduction of verbal prompts for sub-behavior 1, during the baseline phase for sub-behaviors 2 and 3 resulted in a mean percentage of correct responding of 100 for sub-behavior 1 across the 12 sessions (29-40) of this condition. The graph also indicates that the percentage of verbal prompts per session for sub-behavior 1 started out rather high, steadily decreased until the sixth session when it increased dramatically, and maintained a high level until the last session of the condition. The overall mean percentage of verbal prompts per session was 81.

The same graph illustrates that the 100% correct response rate for sub-behavior 1 continued during the two sessions of the treatment phase for sub-behavior 2. The mean percentage of verbal prompts for sub-behavior 1 was 80.

Sub-behavior 2, setting A. The graph for sub-behavior 2, setting A, in Figure 2 presents the mean percentage of correct responses, physical prompts and verbal prompts, per session, for sub-behavior 2, in setting A.

During the baseline phase the subject did not respond correctly in any of the sessions, thus the mean percentage for the four baseline sessions was 0.
As the graph for sub-behavior 2, setting A, in Figure 2 indicates, the initiation of physical prompts, verbal prompts and reinforcement, at session 28, increased the percentage of correct responses to 100 for the first three sessions of this phase (28, 29, 30). As the percentage of physical and verbal prompts decreased, there was a concurrent decrease in the percentage of correct responses, with the exception of the seventh session (34) of this phase. As graph 3 indicates, there was a steady increase in correct responding, starting with the ninth session (36), after the physical and verbal prompts had been completely faded. This increase continued until the twelfth session (39) of this phase when the subject met the criterion for termination of the condition by responding correctly in 15 consecutive unprompted trials.

The mean percentage of correct responses per session, for the sessions in which physical prompts, verbal prompts, and reinforcement occurred (28-32), was 88. This is an 88% increase from baseline levels.

The mean percentage of correct responses per session, for the sessions in which only verbal prompts, and reinforcement occurred (33, 34), was 87. This represents an 87% increase over baseline levels.
The mean percentage of correct responses per session, for the sessions in which only reinforcement occurred (J6-J9), was 82. This is an 82% increase over the baseline levels.

As the graph for sub-behavior 2, setting A, in Figure 2 indicates, the use of reinforcement without prompts resulted in a mean percentage of correct responses per session of 100 for sub-behavior 2 during the three sessions of the treatment phase for sub-behavior 3, setting A. The mean percentage of physical prompts per session was 0, as was the mean percentage of verbal prompts per session.

Sub-behavior 2, setting B. The graph for sub-behavior 2, setting B, in Figure 2 presents the mean percentage of correct responses, physical prompts, and verbal prompts, per session, for sub-behavior 2, in setting B. During the baseline condition for sub-behavior 2, setting B, which occurred at the same time the treatment phase of sub-behavior 2, setting A was in effect, it can be seen that there is a session to session inconsistency in the percentage of correct responses per session. Regardless, there is a gradual over-all increase in the mean percentage of correct responses. The mean percentage of correct responses per session for the first three sessions (29-31) was 16, for the next three sessions (32-34), 31, for the next three sessions (35-37), 38, and for the last three sessions (38-40), 77.
The over-all mean percentage of correct responses per session, for the 12 sessions (29-40) of this phase, was 40.

The graph for sub-behavior 2, setting B, in Figure 2, shows that in the two sessions (41, 42) of the treatment phase for sub-behavior 2, the percentage of correct responses per session was high for both sessions and increased from session 1 (41) to session 2 (42). The mean percentage of correct responses for the two sessions was 87.

The mean percentage of physical prompts per session and verbal prompts per session was 0.

Sub-behavior 3, setting A. As the graph for sub-behavior 3, setting A, in Figure 2 shows, there were no correct sub-behavior 3 responses during the baseline phase for sub-behaviors 2 and 3 and the treatment phase for sub-behavior 2 in setting A. The mean percentage of correct responses per session during each of these two conditions was 0.

The same graph indicates that the initiation of physical prompts, verbal prompts, and reinforcement during the treatment phase produced a large increase in the percentage of correct responses. Although there was a decrease during the second session (41), the percentage of correct responses increased during the last session (42). The mean percentage of correct responses per session was 58. The mean percentage of physical prompts per session was 100.
The mean percentage of verbal prompts per session was 100.

**Sub-behavior 3, setting B.** The graph for sub-behavior 3, setting B, in Figure 2 indicates that there were no correct sub-behavior 3 responses during the baseline phase for sub-behavior 2 and 3 and the treatment phase for sub-behavior 2, in setting B. The mean percentage of correct sub-behavior 3 responses per session, was 0 for each of the two conditions.

**End of session instruction.** The subject never responded correctly to the instruction, "Felipe, stand up and walk forward", which was given at the conclusion of each session.

In setting A the study was interrupted between sessions 37 and 38, and 39 and 40 for 6 and 13 days respectively. In setting B the interruptions of 6 and 13 days occurred between sessions 37 and 38, and 40 and 41 respectively. Due to injuries sustained in falls at the convalescent hospital where he resides, the subject was unable to participate in the study during these periods.

**Probe sessions.** The results of the eight probe sessions are presented by the probe graph in Figure 2. It can be seen that for the probe sessions in which the subject was instructed to perform sub-behavior 1 (1-8), there were no correct responses. Thus the mean percentage of correct sub-behavior 1 responses per session was 0.
The probe graph in Figure 2 shows that for the probe sessions in which the subject was instructed to perform sub-behaviors 2 and 3 (5-8), there were no correct responses for either of these behaviors. Consequently, the mean percentage of correct responses per session for each of these two behaviors was 0.
Discussion

The results demonstrate that behaviors necessary for standing could be trained using physical prompts, verbal prompts, and a reinforcement package consisting of edible, verbal, and tactile reinforcers. Physical prompts, verbal prompts, and reinforcement, together produced a correct response in the majority of sub-behavior 1, 2 and 3 trials. Fading the prompts and using reinforcement alone resulted in a slight overall decrease in correct responses, but the mean percentage of correct responding remained far above baseline levels, thus demonstrating the effectiveness of the reinforcement package.

A comparison of effects across settings within the multiple-baseline design supports the effectiveness of the reinforcement package, especially in the case of sub-behavior 1 and somewhat less clearly for sub-behavior 2. The correct response rate for sub-behavior 1 in setting A increased during treatment but there was no concomittant increase observed in setting B while the baseline condition for sub-behavior 1 remained in effect. The introduction of reinforcement in setting B for sub-behavior 1, produced an instant and dramatic increase in correct responding. Thus it appears that in the case of sub-behavior 1, reinforcement of the behavior seems to be the variable controlling its increase in response rate.
While the treatment condition for sub-behavior 2 produced a rapid increase in correct responding in setting A, there was a concurrent though inconsistent increase in correct responding during the baseline condition for sub-behavior 2, in setting B. Correct sub-behavior 2 responses in setting B may have been the result of residual effects of the reinforcement delivered for sub-behavior 1 responses which preceded the instruction to perform sub-behavior 2. The sub-behavior 2 procedure was followed by the instruction to perform sub-behavior 3 (which ended the trial), and, after several seconds, the instruction to perform sub-behavior 1 (which started a new trial), the performance of which resulted in reinforcement. Therefore it's possible that the effects of reinforcement of sub-behavior 1 extended to sub-behavior 2. The effect might also have extended to sub-behavior 3 except that it was much more difficult and presumed the presence of sub-behavior 2.

The author considered sub-behavior 3 the most difficult sub-behavior since it involved the actual standing response. Although the treatment phase for sub-behavior 3 lasted only 3 sessions, prompt and reinforcer effectiveness was demonstrated. It was apparent that the fading of the prompts would have been a long and drawn out procedure. The subject was not only at
a disadvantage because of the weakness in his legs, but also his equilibrium seemed impaired due to his long confinement in a wheelchair. Because of this, and although the original procedure did not so specify, it seems that the use of parallel bars eventually might have been required in order to successfully train sub-behavior 3.

The results of the sessions demonstrate the extent to which the subject was under stimulus control and his ability to discriminate between an environment in which reinforcers were available and one in which they were absent. Not only did the subject fail to make a correct sub-behavior 1, 2 or 3 response during the probe sessions, he was extremely oppositional to the point of attempting and sometimes succeeding in hitting, scratching, and grabbing the experimenter, or trying to wheel himself away from the experimenter. This oppositional behavior was quite common for the subject when another person was in his bedroom with him attending to his needs or giving him instructions. This type of behavior was also apparent during the baseline condition for sub-behavior 1, in settings A and B, before the reinforcers were introduced. In each setting, once the reinforcers were present and made contingent on a correct sub-behavior 1 response, the oppositional behavior
subsided and the number of correct responses increased. This is in contrast to the subject's bedroom environment where the probe sessions took place and reinforcers were never made available.

One component which this study lacked was the strategy of programming generalization into the procedure. Based on the results of the probe sessions and the absence of generalization of sub-behaviors 1 and 3 in setting B, it seems that this component was necessary. As Stokes, T. F., Baer, D. M., & Jackson, R. L. (1974) state, "The usual need for generalization of therapeutic behavior change is widely accepted, but it is not always realized that generalization does not automatically occur simply because a behavior change has been accomplished." (p. 599). Stokes et al. (1974), were successful in programming generalization using only two experimenters. If their procedure can be adapted to a wider variety of behaviors it's imperative that future studies employ it.

Because the subject received a package of reinforcers after each correct response, the individual effectiveness of each component in the package is difficult to ascertain. By observing the subject, though, it seemed that he strongly relished the ice cream. In many instances he would not only
point to it after responding to an instruction, but would follow the bowl and spoon with his eyes as they were brought to him for the delivery of the ice-cream and then carried back to the table.

Many questions are left unanswered due to the premature termination of the study. Some speculation about the training of sub-behavior 3 is possible due to the three sub-behavior 3 treatment sessions that took place, but anything beyond that would be guessing. It is not known whether the prompts could have been faded, whether the reinforcers were powerful enough to train the sub-behavior 3 response, or if it could be trained, whether the reinforcers would be effective during the walking phase of the study.

What can be stated is that the operant procedures used in this study were effective in training two sub-behaviors that are necessary for standing.
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### Appendix 1

**STANDING**

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**Sub-Behaviors**

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Appendix 2

SPANISH EQUIVALENTS FOR INSTRUCTIONS, VERBAL PROMPTS, AND VERBAL REINFORCEMENT

Instructions for the sub-behaviors.

sub-behavior 1- "Agarrase los lados de la silla, y acercase al borde de la silla." = "Grasp the arms of the wheelchair and slide to the edge of the wheelchair seat."

sub-behavior 2- "Inclinarse en la silla." = "Lean forward in the chair."

sub-behavior 3- "Empujes con tus manos y levantate." = "Push off the chair and stand up."

Verbal prompts.

"mas Felipe" = "more Felipe"
"agarrase los lados" = "grasp the arms(or sides)"
"inclinarse mas" = "lean more"
"suelta de la silla" = "let go of the chair"

Verbal reinforcement

"bueno Felipe" = "good Felipe"
"muy bueno" = "very good"
"muy bien" = "very fine"
"excelente" = "excellent"

End of session instruction.

"Levantate y ande para enfrente." = "Felipe, stand up and walk forward."