

TRAINING PROFOUNDLY RETARDED CHILDREN TO  
STOP CRAWLING<sup>1</sup>

F. O'BRIEN, N. H. AZRIN, AND C. BUGLE

ANNA STATE HOSPITAL AND SOUTHERN ILLINOIS UNIVERSITY

Many profoundly retarded children continue to crawl even though they can walk. Crawling and walking were viewed as two alternative response modes, both reinforced by movement. Children choose the one mode that is easier and faster for them. A training program was designed to increase the ease and speed of walking relative to that of crawling, and consisted of restraint-for-crawling and priming-of-walking. With the program, four retarded children reduced crawling and began to walk instead. When training was discontinued, two children with moderate walking impairment continued to walk rather than crawl. Two children with severe impairment of walking, however, required the occasional use of the restraint procedure to maintain walking as the dominant mode of locomotion. The program was easily administered, required little time, and was effective for all four children.

The development of crawling as a mode of locomotion is a normal development with very young children. Once a child has learned to walk, the substitution of walking for crawling occurs so automatically that it requires little or no active encouragement by parents and teachers. In only one reported case (Harris, Johnston, Kelley, and Wolf, 1964) was a program instituted to increase the use of existing walking skills by a non-retarded child.

Profoundly retarded children of all ages, however, continue to crawl rather than walk. No training procedures have been reported for motivating retarded children who can walk to abandon crawling as their dominant mode of locomotion.

A theoretical analysis of why normal children begin to walk and stop crawling while profoundly retarded children do not suggests a solution to the problem. Movement through space (locomotion) can be considered a class of different response modes, each obtaining identical reinforcement. Walking and crawling are two

alternative response modes of this class. During early development, both normal and retarded children, typically, learn to crawl. Normal children with the requisite learning capacity, coordination, equilibrium, and muscular development also soon learn to walk. With only minimal practice, walking is performed by them with ease and with greater speed than crawling. Such children then choose walking as their dominant mode of locomotion and crawling is gradually reduced and, ultimately, ceases altogether. Profoundly retarded children, however, learn more slowly and in addition to their intellectual handicap, are more often than normal handicapped with other physiological problems (Bensberg, 1965; Berkson, 1963; Malpass, 1963) including leg deformities, blindness, muscular spasticity, imbalance, motor incoordination, etc. These handicaps make walking extremely difficult to learn, and when learned, difficult to perform. As walking remains more difficult and slower than crawling, these children continue to choose crawling as their dominant mode of locomotion and without some intervention rarely even attempt to walk. Under such circumstances, walking skills are not improved, whereas, continued use of the crawling skills provides the necessary practice to improve

<sup>1</sup>This study was supported by the Illinois Department of Mental Health and by NIMH Grant MH17981. Reprints may be obtained from F. O'Brien, Behavior Research Laboratory, Anna State Hospital, Anna, Illinois 62906.

that skill. Consequently, crawling gradually becomes even more preferred than walking as the child's dominant mode of locomotion.

This analysis suggests that profoundly retarded children would choose to walk rather than crawl if walking were made easier and faster for them than crawling. Two methods to accomplish this would be: (1) provide practice of walking to improve its ease and speed, and (2) intervene to decrease the ease and speed of crawling. The practice of walking could be obtained by regularly scheduled training periods (Meyerson, Kerr, and Michael, 1967; Loynd and Barclay, 1970), inhibition of crawling by a noxious punisher (Azrin and Holz, 1966), and the encouragement of walking by an extrinsic reinforcer (Harris, *et al.*, 1964). The present study attempted to use reinforcers, inhibitors, and practice periods that were natural to the locomotive process, rather than contrived events, because the natural events would be easier and more likely to be employed. The principle of response priming (Ayllon and Azrin, 1968; Azrin and Powell, 1969; O'Brien, Azrin, and Henson, 1969) was utilized to provide a practice procedure that consisted of priming walking by raising the crawling child to a walking posture. The ease and speed of crawling was reduced by physically preventing the crawling responses from resulting in movement through space (restraint). The training program, which included response priming-of-walking and restraint-of-crawling, was applied in a day-care nursery school. The role of the component-procedures was analyzed with one child in a structured observation setting wherein component procedures were used alone, in combination, and in varied sequences.

## METHOD

### *Subjects and Setting*

Four children, ages 5 through 7 yr, were enrolled in a day-care nursery school program for profoundly retarded children. This program was in session 6 hr daily, five days a week. Dur-

ing most of the day, the children had no opportunity to crawl (*e.g.*, seated for verbal training, meals, imitation training, *etc.*). When locomotion during such scheduled activities occurred, the teacher usually provided continued assistance to insure walking (*e.g.*, the teacher's raising a child from a seated posture and holding the child's hand as they walked). Locomotion was required, however, as the children moved between four different rooms and an outdoor play area as a scheduled aspect of the program. With a greater student-to-teacher ratio, teachers were unable to provide continued assistance to the children during these periods. The frequency of this required locomotion was about 25 times per child, daily. Crawling during such required locomotion periods greatly hindered the normal operation of the nursery program. Three of the four children (JL, RK, and JR) were females and one (CT) was a male. When tested with the Stanford Binet for IQ by an independent agency just before the study, all four were unable to achieve any score and were designated "untestable". The children were not toilet trained, could not dress themselves, had no other self-care skills, and spoke not even one word. All four children were observed to walk occasionally. For JR and CT, walking was performed with moderate coordination and balance. For RK and JL, however, walking was accomplished only with difficulty, awkwardness, and with frequent falling. For several months, the teachers had tried a variety of procedures to reduce crawling, including response priming of walking whenever they crawled. No noticeable improvement resulted from these procedures, which were administered during the period immediately preceding the study.

### *Response Recording and Reliability*

Crawling was defined as uninterrupted movement across the floor for at least 3 sec with the knees in contact with the floor. Walking was defined as uninterrupted movement across the floor for at least 3 sec but with the soles of the feet contacting the floor. During the highly

structured portion of the study, two independent observers recorded the child's locomotion, using instruction sheets containing the above definitions. The observers depressed one push-button switch when the child walked as defined and another switch when the child crawled. This recording was performed through two separate one-way mirrors from two separate rooms. The switches activated timers and counters in a different room. White noise was provided through earphones to eliminate the possibility that the observers heard the operation of the recording apparatus.

During the portion of the study in the nursery program, five different teachers using the same definition of crawling recorded each observed instance by immediately writing the time of day it occurred on standard recording sheets placed in several easily accessible locations. Each teacher was trained to record at several meetings for that purpose. As the definition of crawling included 3 sec of movement, each teacher was trained to determine 3 sec by covertly counting "one-thousand-one, one-thousand-two, one-thousand-three." Since two or more of the teachers were usually present, the one nearest the recording sheet did the recording. The presence of more than one teacher decreased the chance that crawling could go unnoticed or that a teacher might forget to record. In addition, one or more of the authors was present in the setting most of each day throughout the study and provided feedback to the teachers concerning their recording. (Only three occasions of disagreement with any recording incident were noted.)

#### *Procedure*

The structured portion of the study took place in a large room (30 by 20 ft) that contained two chairs, one in each of two diagonally opposite corners. A child with severe walking impairment, RK, served. An adult located herself in a corner of the room that included a chair, called the child by name, and verbally encouraged her to come to that corner of the room. When the child arrived within one foot of the

adult, whether by walking or crawling, the adult immediately said "Good girl", touched her affectionately and placed one of a variety of favored food bits into the child's mouth. The food bits included M & Ms, sweetened dry cereal, chocolate stars, candy corn, and animal cookies. The adult, then, immediately moved to the diagonally opposite corner of the room and repeated the procedure, alternating in this manner until the end of the session.

A second adult provided the training procedures. For standardization, she started each trial with the child in an off-feet posture. The chairs enabled the child to raise herself at the start of a trial, should she care to do so. Four different procedures were conducted:

(1) *No training*. The child was given the alternating trial procedure described above with no other interaction with adults.

(2) *Restraint*. When the child crawled for 3 sec, the trainer held the child by the waist from behind for 5 sec, allowing her to make crawling movements but not to move forward.

(3) *Response priming*. When the child crawled for 3 sec, the trainer raised the child to a standing position, allowing her to walk in the direction she was crawling.

(4) *Restraint and response priming*. When the child crawled for 3 sec, the trainer held the child by the waist for 5 sec, then placed the child in a standing position.

Three 10-min sessions were scheduled daily, each separated by about 1.5 hr. Only one session occurred the first day. Each procedural change was made within a day so that the first session of a new procedure occurred on the same day as the last session of the previous procedure. The procedural sequence was: no training, restraint-alone, restraint and priming, no training, priming alone, no training, restraint alone.

With the results from the structured study and consultation with the authors, the teachers of the nursery program instituted training with restraint and priming. Remarkable success was reported after nine days of training; however,

written records had not been taken. Recording, as discussed, was initiated on the following day. In addition, two staff members were asked to submit an estimate of the frequency of crawling on the three days preceding training. During the remainder of the study, the teachers conducted the normal program; in addition, they recorded crawling when it occurred and conducted the training procedures listed below. Three children served as subjects, one with severe and two with only moderate walking impairment. The teachers did not provide edibles or any other contrived reinforcers for walking or crawling. The procedural sequence was: restraint and priming, then, post-training. For one of the children (JL), restraint alone followed post-training.

### RESULTS

Figure 1 presents the results of the structured study with RK, a child with severe impairment of walking. This child's crawling is presented as a percentage of the time she spent in locomotion (*i.e.*,  $\text{Time Crawling} / \text{Time Walking} + \text{Crawling} \times 100$ ). The mean difference per session between the two percentage scores for the two observers was only 2.5. Similarly, the reliability of the frequency of crawling between the two observers was 99.6% per session. During the initial no-training period, the child crawled more than 80% of the time she spent in locomotion. When restraint alone was introduced, all locomotion was by crawling. Not shown in the figure is that the absolute amount of time the child spent crawling during these three sessions was less than half of the amount of time spent crawling during the first three no-training sessions. When restraint and priming was introduced, locomotion by crawling immediately decreased to about 50%, and progressively decreased to nearly zero during these six sessions, totalling 60 min. It was noted during this period that the child was progressively becoming more proficient in attaining a walking posture using the chairs in the corners of the

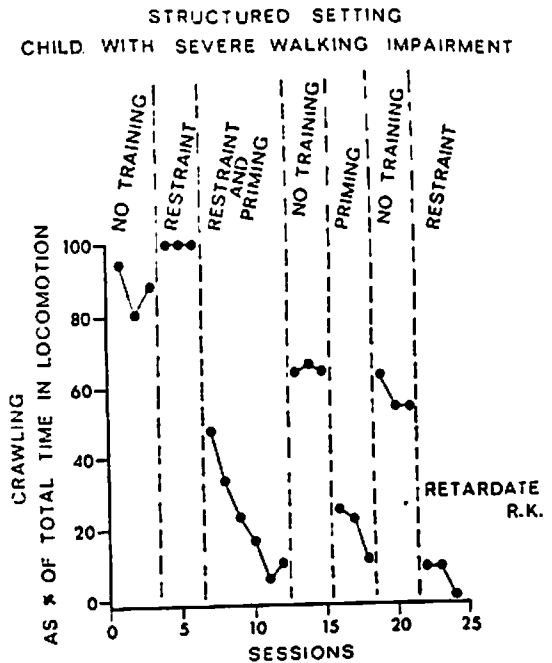


Fig. 1. The percentage of time in locomotion a profoundly retarded child with severe walking impairment spent by crawling. The percentage was calculated by dividing the time the child spent crawling by the time she spent walking and crawling (*i.e.*,  $\text{Crawling} / \text{Walking} + \text{Crawling}$ ) and multiplying by 100. Three 10-min sessions were scheduled daily. Restraint consisted of a teacher's restraining the child from crawling for 5 sec each time the child crawled. Priming consisted of raising the child to a walking posture each time the child crawled. Restraint and priming involved priming walking immediately after the 5-sec restraint.

room. The child also began to offer increasing assistance during priming in attaining a walking posture. When training was discontinued (no training), crawling immediately increased to about 60%, a level substantially lower than during the initial no-training sessions. When priming-alone was introduced, crawling decreased to about 25% and continued decreasing to about 10% during the three sessions. The return to the no-training condition resulted in about 50% of the child's locomotion occurring by crawling, a lower level than during either no-training period preceding it. When restraint alone was introduced again, crawling immediately decreased to about 10%, and by the last of the three sessions was zero. During this pe-

riod, it was typical for the child to stand and walk immediately after restraint was used.

Not shown in this figure is that the absolute duration of time spent crawling decreased from a mean of 3.9 min during the initial three no-training sessions to a mean of 0.2 min during the last three sessions. While crawling decreased over this period, the absolute duration of time spent walking increased per session from a mean of 0.5 min to 2.5 min.

Figure 2 presents the frequency of crawling in three-day means for J.L., a child with severe impairment of walking, during the nursery school program. By the tenth day of training (no data recorded for the first nine days), the child was crawling only three times a day. This apparently was an impressive reduction as reported by the teachers and as compared to the estimated frequency before training, which was 35 times crawling per day. While restraint and

response priming were in effect, crawling decreased to less than once daily. The reduction of crawling to this low level occurred within 20 days and was maintained while restraint priming remained in effect. When restraint priming was discontinued (post-training), crawling remained at this low level for nine days and on the tenth day began to increase, still remaining below the estimated level of 35 responses before training. When restraint alone was introduced, crawling immediately decreased to less than once daily and remained at zero during the final 21 days of the study. During this restraint period, the child typically raised herself to a walking posture immediately after restraint.

Figure 3 presents the results for the two children with moderate impairment of walking in the nursery school program. By the tenth day of training (no data recorded for the first nine days), CT and JR were crawling only six and three times respectively. As for the child with severe walking impairment, the teachers re-

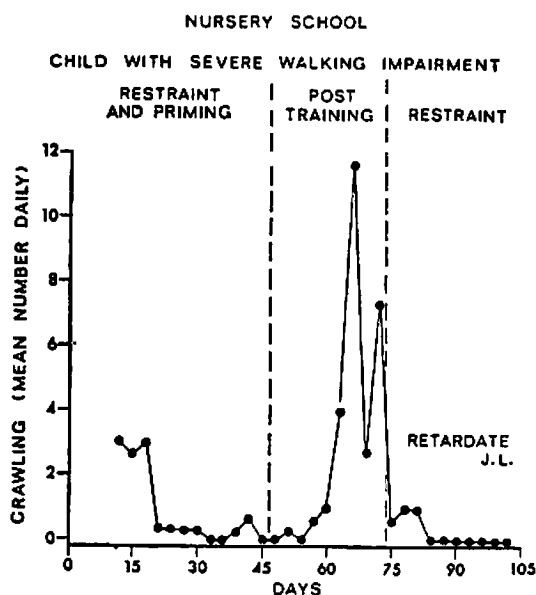


Fig. 2. The frequency of crawling during a 6-hr per day nursery school program, in three-day means, for a profoundly retarded child with severe walking impairment. No recordings were made during the first nine days of training. Restraint consisted of a teacher's restraining the child from crawling for 5 sec each time the child crawled. Priming consisted of raising the child to a walking posture each time the child crawled. Restraint and priming involved priming walking immediately after the 5-sec restraint.

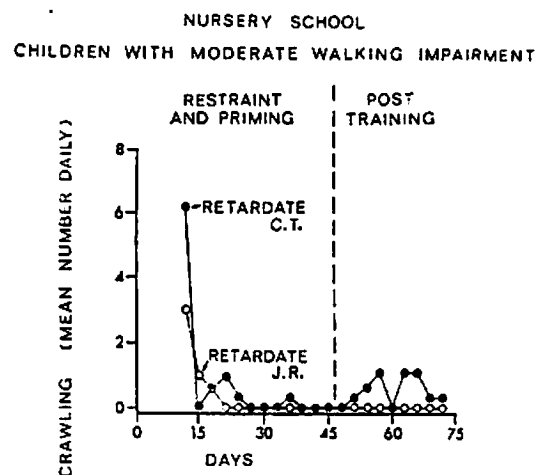


Fig. 3. The frequency of crawling during a 6-hr per day nursery school program, in three-day means, for profoundly retarded children with only moderate impairment of walking. No recordings were made for the first nine days of training. Restraint consisted of a teacher's restraining the child from crawling for 5 sec each time the child crawled. Priming consisted of raising the child to a walking posture each time the child crawled. Restraint and priming involved priming walking immediately after the 5-sec restraint.



ported this to be an impressive reduction. The teachers' estimate of crawling before training was 35 for CT and 15 for JR. While the restraint-priming procedure was in effect, the frequency of crawling was reduced to zero or less than once daily for both children. This low frequency of crawling was reached in about 15 days for both children and was maintained for the next 30 days while training remained in effect. When restraint and priming was discontinued (post-training), the frequency of crawling remained at zero or about once daily.

For the children enrolled in the nursery program, walking necessarily increased as crawling decreased, since the frequency of required locomotion between rooms of the nursery program remained constant at about 25 times per day throughout the study. Since teachers never carried children, a reduction of crawling during these periods necessarily represents an increase in some alternative mode of locomotion. For these children, their only alternative was walking.

Approximately 1.5 yr later, two of the three children were still enrolled in the nursery school program; the restraint procedure, however, had been discontinued for at least a year. The children were observed to be walking almost exclusively and staff members reported that crawling rarely occurred. For a three-day observation period, the mean number of instances of crawling per day was zero for each child.

## DISCUSSION

The training program of restraint-for-crawling and priming-of-walking resulted in all four profoundly retarded children crawling less and walking more. This improvement occurred regardless of the child's degree of walking impairment and in a structured training situation as well as during an ongoing nursery program. During the final phases of training, the children crawled no more than once daily, or less than 10% of the time spent in locomotion, a level acceptable for children of that age.

The training procedures should be easily administered in most settings with retarded children. No expenses for new equipment, apparatus, or reinforcers were required, but rather, the natural setting with its intrinsic reinforcers was used. The amount of staff time devoted to the training program was minimal, requiring 5 sec for restraint, and about 2 sec for priming each time a child crawled. Within one week of training, no child crawled more than seven times a day requiring, therefore, less than 1 min of staff time. After three weeks, only a few seconds were required because the children crawled less than once daily.

Since the training program included two component procedures, restraint-for-crawling and priming-of-walking, a question remains as to whether either component alone would have produced the effect. Two lines of evidence relate to this question. The first was the use of restraint alone with the one child in the structured study. The child did decrease crawling; however, the child also ceased walking. This was not true of the combined procedure, during which walking increased as the child reduced crawling. The second line of evidence is when priming alone was used for weeks before the study. During the combined procedure, however, the children initiated walking themselves. Before the combined use of both component procedures, therefore, neither of the component procedures alone appeared sufficient. A previous attempt to train proper self-feeding to a profoundly retarded child similarly demonstrated that neither facilitation of proper skills nor the inhibition of improper responses was initially effective alone (O'Brien, Bugle, and Azrin, 1972). These results are also in accord with laboratory studies demonstrating the increased effectiveness of combined facilitation and inhibition procedures as compared with either of the component procedures alone (Azrin and Holz, 1966; Catania, 1966; Herman and Azrin, 1964; Holz, Azrin, and Ayllon, 1965).

After restraint and priming were used in combination, restraint seemed effective alone.

When used after the combined procedure, the child typically initiated walking, independently, immediately after she was restrained for crawling. When restraint alone was in effect, therefore, walking was primed, albeit by the child herself. Thus, after both restraint and priming are used in combination, restraint-alone appears sufficient.

When training was discontinued, some permanent improvement was noted for all four children. For the two children with only moderate impairment of walking, crawling remained at a level normal for children of that age. For the two children with severe impairment of walking, a degree of crawling returned that was unacceptable, even though substantially lower than before training. That the improvement was not sufficient for them suggests that the greater the degree of walking impairment, the more time need be devoted to training. Restraint was, therefore, reintroduced and the children walked rather than crawled. Even though restraint was discontinued after a few months, the children were walking almost exclusively 1.5 yr after training.

## REFERENCES

- Ayllon, T. and Azrin, N. H. Reinforcer sampling: a technique for increasing the behavior of mental patients. *Journal of Applied Behavior Analysis*, 1968, 1, 21-34.
- Azrin, N. H. and Holz, W. C. Punishment. In W. K. Honig, (Ed.), *Operant behavior: areas of research and application*. New York: Appleton-Century-Crofts, 1966. Pp. 380-448.
- Azrin, N. H. and Powell, J. A method of improving self-administration of prescribed drugs by response priming. *Journal of Applied Behavior Analysis*, 1969, 2, 39-43.
- Bensberg, Gerald J. Helping the retarded grow and learn. In G. Bensberg (Ed.), *Teaching the mentally retarded*. Atlanta, Georgia: Southern Regional Education Board, 1965. Pp. 19-39.
- Berkson, G. Psychophysiological studies in mental deficiency. In Norman R. Ellis (Ed.), *Handbook of mental deficiency*. New York: McGraw Hill, 1963. Pp. 556-573.
- Catania, A. C. Concurrent operants. In W. K. Honig (Ed.), *Operant behavior: areas of research and application*. New York: Appleton-Century-Crofts, 1966. Pp. 213-271.
- Harris, E. R., Johnston, M. K., Kelley, C. S., and Wolf, M. Effects of positive social reinforcement on regressed crawling of a nursery school child. *Journal of Educational Psychology*, 1964, 55, 35-41.
- Herman, R. L. and Azrin, N. H. Punishment by noise in an alternative response situation. *Journal of the Experimental Analysis of Behavior*, 1964, 7, 207-209.
- Holz, W. C., Azrin, N. H., and Ayllon, T. Elimination of behavior of mental patients by response-produced extinction. *Journal of the Experimental Analysis of Behavior*, 1963, 6, 407-412.
- Loynd, J. and Barclay, A. A case study in developing ambulation in a profoundly retarded child. *Behavior Research and Therapy*, 1970, 8, 207.
- Malpass, L. F. Motor skills in mental deficiency. In Norman R. Ellis (Ed.), *Handbook of mental deficiency*. New York: McGraw Hill, 1963. Pp. 602-631.
- Meyerson, L., Kerr, N., and Michael, J. L. Behavior modification in rehabilitation. In S. W. Bijou and D. M. Baer (Eds.), *Child development: readings in experimental analysis*. New York: Appleton-Century-Crofts, 1967. Pp. 214-239.
- O'Brien, F., Azrin, N. H., and Henson, K. Increased communication of chronic mental patients by reinforcement and by response priming. *Journal of Applied Behavior Analysis*, 1969, 2, 23-31.
- O'Brien, F., Bugle, C., and Azrin, N. H. Training and maintaining a retarded child's proper eating. *Journal of Applied Behavior Analysis*, 1972, 5, 67-72.

Received 16 August 1971

(Revised 22 November 1971)