TOILET TRAINING OF NORMAL AND RETARDED CHILDREN¹

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Early elements in an operant chain of toilet behaviors were trained in three normal infants and five retarded children. Following that, eliminative behaviors were conditioned by operant procedures. Each child was equipped with an auditory signalling device that gave cues to the learner. Baseline behavior was recorded for a period of five days. The procedure for training consisted of two steps. First, a response was obtained through physical, verbal, and auditory prompts. Second, prompts were faded until the child responded in the presence of the auditory signal. When the device was removed the child performed without the auditory prompt. Parents were instructed in a similar procedure to enhance generalization in the home. Seven of the eight subjects reached a criterion and maintained that behavior during three criterion sessions.

Acceptable toileting behavior includes walking to the commode at the appropriate times, removing clothing, eliminating in the commode, and replacing clothing. It also includes learning not to eliminate in clothing and not to eliminate at locations other than the commode. Parents often find this training, in all of its aspects, a difficult task (Spock, 1968). In common practice, parents do not undertake the total task at once. They begin with the eliminative event by placing the child on the "potty" chair. If the child learns to eliminate in the receptacle, then other aspects of the task are undertaken.

Rapidity of the training, however, may depend on what the child learns first. Van Wageningen, Meyerson, Kerr, and Mahoney (1969), have argued the merits of training behavior in the same temporal order as its final form and for close association of each of the elements in the chain of behavior. This means, essentially, that the elements should all be practiced together in their approximate final form. Van Wageningen *et al.*, (1969) dealt with

the urinary component and began training their subjects when a reflex-urination event occurred.

The present experiment, investigated the merits of training the subject to walk to the commode, in response to an auditory signal triggered by the experimenter, remove clothing, sit on or stand in front of the commode, replace clothing, and return to play without regard to eliminations. The rationale for the procedure was this: since eliminating acts are infrequently occurring reflexes under the control of physiological processes in the child, they permit only a limited number of conditioning trials to elaborate them as operants. We therefore first arranged for practice, in the presence of the auditory prompt, of all the acts of toilet behavior. Once these behaviors were under the control of the auditory prompt, manual activation of the signal was terminated. At that time, a switch was thrown that permitted the signal to originate from the flow of urine. The child was then expected to exhibit toileting behavior whenever reflex voiding was initiated.

METHOD

Subjects

Two groups of subjects were selected from incontinent children referred to the experimenter because their parents wanted them toilet trained. Selection criteria were as follows: (a) the child was ambulatory; (b) he was

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available for an 8-week period; (c) transportation was available for the child.

Group I was composed of three normal infants (Subject 1, Subject 2, and Subject 3) all of whom had five to 10 words of speech. Subject 1 and Subject 2 were 20- and 21-month-old males, and they had good motor behavior. Subject 3, 18 months old, was the only female in the study and she had poor motor behavior.

Group II was composed of five male retardates (Subject 4 through Subject 8) whose scores ranged from 10 to 45 on the Cattell Infant Intelligence Scale. The first four subjects were 4 yr old. The fifth child, Subject 8, was 9 yr old and profoundly retarded. Subjects 4 and 5 had excellent motor behavior; Subject 5 was the only retarded child to have speech. His vocabulary consisted of three to five words. Subjects 6 and 7 had poor motor behavior and Subject 6 had a severe hearing loss and paralysis of the right hand.

Setting

The study was conducted at the Mesa Association for Retarded Children School, Mesa, Arizona. A 20 by 17 ft room adjoining a toilet facility was used for training. The room contained a table, six chairs, and an assortment of toys. The adjoining lavatory was equipped with a child-size tank-type commode, a portable plastic potty chair, and a lavatory.

Apparatus

Each subject in training wore a modified model of the signal-generator-urinal pants reported by Van Wagenen *et al.*, (1969), which produced an auditory signal on the occurrence of urine flow. The device (\$100, Mark II Toilet Trainer, Psytec, P. O. Box 26006, Tempe, Arizona 85281) was modified in two ways. First, it was coupled with a miniature radio receiver, through which an audio alert could be triggered by the operation of an FM transmitter. The experimenter, in operating the radio transmitter, could cause the toilet training device to sound its audio signal at any time simply by the push of a button. This in no way interfered with the automatic operation of the toilet training device as a consequence of a urinary event. The receiver and the transmitter, both operated on a single FM channel.

A second variation in the apparatus was replacement of the usual speaker by two low

impedance transistor radio earphones (Lafayette, 99H2548). One earphone produced minimally enough sound to replace the speaker at its usual mounting on the receiver-signal-generator-package. The experimenter was able to hear the earphone signal across the width of the training space. The second earphone was mated to a standard ear mold and placed in the subject's ear. The use of the earphone reduced the possibility of audio interference from irrelevant stimuli in the training space.

The 6-ounce receiver package (\$30, Controilaire SH-100, Controilaire Division of World Engines Incorporated, 8960 Rossash Avenue, Cincinnati, Ohio 45236) was contained in a 3 by 3 by 3.5 in. metal box (7.6 by 7.6 by 9 cm) and powered by a 2.80-battery. The transmitter (\$40, Controilaire Mark II) was housed in a 5 by 3 by 7 in. (12.7 by 7.6 by 17.8 cm) metal box and had an average radiated power of between 150 and 175 milliwatts. The receiver operated at a frequency of 27.095 megacycles and responded at a distance of 15 to 30 ft. A class "C" citizen's license is required to operate this device legally.

Figure 1 shows the transmitter and the receiver-signal-generator-package worn by the subjects.

Procedure

Baseline period. Each subject was brought to the experimental room to establish a baseline of urinary performance. Subjects were observed during daily 3.5 hr sessions for a minimum of five days. They were clothed in cotton pants and T-shirts only. On entering the experimental environment, each subject was shown the location of the commode and potty chair. Pants were checked every 15 min and changed when wet.

A baseline record was also kept of the number of toileting responses. Adequacy of toileting response was rated at zero or one of 10 behavioral levels of toileting adequacy and recorded on a data chart. These levels were identical to those used for recording experimental results. The untrained state of urinating through the pants, without any attempt to walk to the commode, was represented on the chart at Level 0. Level 10 on the chart was the criterion performance of independently walking to the commode, removing clothing,

Fig. 1. Positioning of the auditory receiving device on the child and the signal transmitter held by experimenter.

eliminating in the commode, and replacing pants.

At irregular times throughout the baseline sessions, the experimenter approached each subject and presented one of the following commands: (a) "Go to the potty", (b) "Pull your pants down", and (c) "Pull your pants up" (after experimenter had pulled them down). The purpose of this procedure was to obtain a pretraining measure of each subject's response to the verbal instructions. The three commands were presented to each subject three times per session for a total of 15 during the 5-day period. Responses to the experimenter's instructions were recorded.

Prerequisite behavior training period. The purpose of this period was to teach the subject the behavior sequence that typically precedes the act of eliminating in a commode. The component behaviors included: (1) walking to the commode, (2) lowering pants, and (3) sitting on, or facing, the commode. The subject was equipped with a receiver-sig-

nal-generator-package and trained, individually, in daily 1-hr sessions. Training was continued until all three of the component behaviors were brought under the control of the training conditions. The criterion for proceeding to the next higher level of training was three consecutive appropriate responses, each within 3 sec after the onset of the auditory signal. The response was required to result clearly from the sounding of the auditory signal.

Parents were asked to withhold liquid and food 1 hr before each training session. These were withheld to increase their effectiveness as reinforcers and to minimize the chances for bowel elimination during the training sessions. Reinforcers consisted of the combination of social praise and food.

The procedure for training each of the prerequisite behaviors consisted of two steps. First, a response was obtained through the use of physical, verbal, and auditory prompts. Second, prompts were faded until the child responded only in the presence of the auditory signal.

Phase 1: teaching the subject to walk to the commode in response to the auditory signal. The first step was to obtain the behavior of walking to the commode in response to physical, verbal, and auditory stimuli. Toys were placed near the entrance to the lavatory so as to occupy the subject at that location. The experimenter activated the transmitter signal for 5 sec while saying: "Let's go potty," took the child by the hand, and led him to the toilet. On subsequent trials, the speed of walking was increased, the experimenter moved further and further ahead of the child, and toys were placed at increasing distances from the facility. Walking to the lavatory was reinforced by the experimenter, who placed a consumable in the subject's mouth, and verbally and gestually approved by clapping the hands and saying: "good boy!" or "good girl!"

The second step was to fade out the physical intervention and verbal prompts of experimenter when the auditory signal sounded. As before, experimenter activated the transmitter but gradually reduced the use of verbal prompts and hand gestures. In the process, the experimenter progressively moved himself to a position behind the subject so that the child eventually entered the lavatory first. Reinforcement was contingent upon walking

to the lavatory within 3 sec of the onset of the auditory signal.

Phase 2: teaching the subject to lower his pants. Pants lowering was brought under the control of verbal and physical prompts as in Phase 1. The signal was used only to bring the child to the commode. When the subject was at the commode, the experimenter placed the child's hands on the sides of the training pants near the leg opening and moved the hands through the motions of pulling the pants down. These hand movements were accompanied by experimenter's instructions: "pull your pants down". Reinforcement was contingent upon walking to the commode and lowering training pants to a point just below the knees. The pants were then pulled up by the experimenter.

The next step was to fade the verbal and physical prompts as follows: first, the experimenter and subject together lowered the pants. Second, experimenter gradually shifted his hands up the subject's arms and so increased the distance between his own hands and those of the subject, until the child lowered his pants independently in response to the signal. As before, the pants were replaced by the experimenter.

Phase 3: teaching the subject to sit on the toilet seat or take the proper male stance while facing it. The behavior of sitting on the toilet seat or standing in front of it was brought under the control of physical prompts in similar fashion to the earlier procedure. The auditory signal was generated manually as before and the reinforcer was delivered for walking to the toilet and lowering pants. The experimenter then sat female subjects on the commode or potty or positioned male subjects in front of the commode. Subjects were restrained at the commode by the experimenter who placed his hands around subjects' shoulders. On the first trial, subjects were restrained for 10 sec. Gradually on the later trials, the restraining time was increased to a maximum of 30 sec. Reinforcement was given if the subject sat for the required time on the toilet or stood with pants lowered while facing it. At the end of the time period, the experimenter took the child off the commode, pulled up the pants, and connected them to the signal package.

The second step was to fade the physical aid and restraint. The experimenter generated

the signal to bring the subjects to the lavatory. When at the commode, the experimenter gradually reduced the physical assistance given female subjects in mounting the toilet seat. For males, the experimenter gradually reduced the tension with which he held the child in front of the commode. Reinforcement was contingent upon independent sitting or standing for a period of 30 sec. On successful fulfillment of the third phase, subjects were brought together in the training space for the succeeding training sessions.

Elimination Training and Clothing Return

When the subject completed the training, he had demonstrated his ability to walk to the commode, remove pants, and assume the sex-appropriate stance. The last three phases involved bringing elimination and clothing return under the control of physical, verbal, and auditory prompts.

Elimination training was limited by the frequency with which each subject "naturally" eliminated. To increase the total number of urinations occurring during a training session, subjects were trained in a group and offered liquids to drink at frequent intervals. As a result, the experimenter's time was occupied in training or dispensing of liquid. The three normal subjects made up Group I while Group II consisted of the five retarded children. The liquid consisted of fruit punch and was offered in a 5-ounce plastic drinking cup.

When eliminations occurred regularly at the commode, the auditory signalling device was removed and the child demonstrated his learning by "using the toilet" independently, and without the auditory prompt. To initiate elimination training, only one subject was equipped with the radio receiver. Radio receivers were removed from all of the remaining subjects. That single subject, who at that time became the focus of training, was also equipped as before with the urinary-signal-generator. When the experimenter could see that some other child was ready to eliminate and was not wearing a receiver, the experimenter simply exchanged devices. This required very little time and could be compared to moving an object from one pocket to another. The training continued as follows.

Phase 4: exposing subjects to the appropriate receptacle and inducing the consumption of liquids. When subjects had consumed a

minimum of 10 ounces of liquids, the experimenter selected a subject for elimination training. The experimenter manually generated the signal, as before, and the child was reinforced for demonstrating the behaviors learned at prior levels. The purpose of the experimenter-initiated sequence was to practice earlier acquired behavior and to expose the child to the commode during a period in which he had consumed a large quantity of liquid. If, by chance, the child eliminated in the receptacle during the 30-sec period of sitting on or standing at the commode, that behavior was reinforced. On the other hand, if the subject did not eliminate during this exposure period, the experimenter pulled the pants up and the child was allowed to leave the lavatory. If, when the subject was playing and an elimination occurred in his pants the auditory signal was produced automatically and if the previously learned chain of responses was not manifested, the experimenter immediately induced them; *i.e.*, walk to the commode, remove pants, and sit on or face toilet seat. However, at this level, reinforcement was not given unless the child reinitiated the voiding response at the commode. Wet pants were removed without comment.

After each subject had eliminated in the receptacle at least once, in response to the experimenter-initiated auditory signal, eliminations in the pants were followed by the experimenter saying: "NO! Go potty." It was assumed that the urine-initiated auditory signal and the verbal comments by experimenter would act to prompt the subject to respond in ways that he had demonstrated in the past. Again, reinforcement was contingent upon some urine in the receptacle.

Phase 5: teaching subjects to pull up their pants. The training procedure at this phase was similar to Phase 2. The first step was to bring pants lowering under the control of physical and verbal prompts. The signal was generated by experimenter or urine flowing in the pants and reinforcement was given for walking to the commode, lowering pants, taking the appropriate position at the commode, and urinating in the receptacle. After an elimination in the receptacle, the experimenter took the subject's hands and placed them on the sides of the training pants near the waistband and the pants were pulled up by the experimenter and the subject together. These

hand movements were accompanied by the experimenter's command: "Pull your pants up!" Reinforcement was contingent upon pulling up the pants to cover the buttocks.

The second step was to fade the verbal and physical prompts supporting clothing return. As experimenter and subject together pulled up the pants, the experimenter gradually increased the distance between his hands and those of the subject, until the child was pulling up his pants independently. Reinforcement was contingent upon the subject pulling up his pants independently.

Phase 6: practicing behavior chain without the support of the auditory signal. When a complete sequence of toileting responses had been built up, it was necessary to strengthen the control that the auditory signal had over the previously learned behavioral sequence. At this stage in training, the experimenter had learned to identify for each subject some specific overt responses, which in the past often preceded the act of eliminating. These responses included, for example, a sudden increase in motor activity, tugging at training pants, or holding of the genitals. When one or more of these responses appeared, the experimenter initiated the auditory signal manually with the expectation that the child might walk to the commode, remove clothing, eliminate in the receptacle, and replace clothing. Reinforcement was contingent upon the child completing the entire chain in response to the auditory signal.

The final act of training was to remove the auditory signalling device and ensure compliance to the training regime without it. On full and correct completion of the third consecutive behavior sequence, in response to the auditory signal, the device was removed. Further trials, without the device, were maintained by continuing the practice of offering the child quantities of liquid. Reinforcement was then contingent upon the subject initiating independent performance of the total sequence of toileting behavior without signals or prompts.

Sessions to confirm training and ensure the transfer. The last three training sessions served three functions. First, they provided a fixed period of time that was used to measure the stability of the subject's toilet behavior and to compare it with his entering behavior.

Second, the sessions were used to teach the four verbal subjects the word "potty". As the subject walked, independently, to the commode he was interrupted by the experimenter who said: "where are you going?" If the subject responded with the word "potty", which had been paired with trips to the commode during earlier training, he was released and allowed to continue on to the lavatory. However, if the child did not respond, the experimenter prompted him to say the word.

Third, this time was used to instruct the parent to institute a similar training procedure at home, in an attempt to achieve generalization of the behavior. During this instruction period, the subject's parent was brought into the experimental room and, while observing her child's performance, she was instructed in aspects of the procedure that did not require the signalling device.

Follow-Up

After the formal training sessions were completed, one parent from each group was selected to provide information on her child's progress in the home. On the basis of an expressed willingness to provide this information, the mothers of Subject 2 and Subject 8 were selected. Over a period of six months, information was obtained during 13 uniformly

spaced telephone conversations between the experimenter and each parent.

RESULTS

The individual acquisition curves for normal subjects of Group I and retarded subjects of Group II are shown in Fig. 2 and Fig. 3 respectively. Seven of the eight subjects reached the criterion level during the training sessions and maintained that behavior during three criterion test sessions. Normal, younger subjects attained the criterion performance in an average of 29 hr and 118 trials. Much of the training time was devoted to attentions unrelated to toilet training. The older, mentally retarded subjects reached criterion in 29 hr and 262 training trials.

Baseline Sessions

None of the subjects walked to the commode or responded appropriately to all three commands. Subject 4 responded to two of the 15 presentations by pulling his pants down and up. Subject 5 correctly lowered his pants three times and pulled them up twice. The number of times Subjects 1 to 8 urinated on the floor or in their pants during the five sessions was as follows: 13, 12, 22, 15, 28, 12, 11, and 19 times. None of the subjects urinated

- LEVELS
- 10 Walk to commode, lower pants, urinate in commode, pull pants up. No prompts or auditory signal.
 - 9 Walk to commode, lower pants, sit on or stand in front of commode, urinate in commode, pull pants up, in response to auditory signal.
 - 8 Walk to commode, lower pants, sit on or stand in front of commode, urinate in commode, pull pants up, in response to auditory signal and prompts.
 - 7 Walk to commode, lower pants, sit on or stand in front of commode, urinate in commode, in response to E or urine initiated auditory signal.
 - 6 Walk to commode, lower pants, sit on or stand in front of commode, in response to auditory signal.
 - 5 Walk to commode, lower pants, sit on or stand in front of commode, in response to auditory signal and prompts.
 - 4 Walk to commode, lower pants in response to auditory signal.
 - 3 Walk to commode, lower pants in response to auditory signal and prompts.
 - 2 Walk to commode, in response to auditory signal.
 - 1 Walk to commode, in response to auditory signal and prompts.

Fig. 2. Acquisition of toilet behaviors for normal subjects. Each point on the curve represents the average level of performance for a block of trials. Numbers with arrows represent the cumulative hours of training. The criteria for each level of performance are listed to the left of the top graph.

Fig. 3. Acquisition of toilet behaviors for retarded subjects. Each point on the curve represents the average level for a block of trials. Numbers with arrows represent the cumulative hours of training.

in the commode at any time during the baseline observations.

Training Sessions

The cumulative number of trials required for each subject to attain the various levels of performance are presented in Fig. 2 and 3. A description of each behavior level appears with the graph for Subject 1. Levels 1 through

9 represent qualitative approximations to the terminal behavior at level 10, but they do not represent quantitatively equal intervals. Each plotted point is the average level of performance over a block of 10 training trials. In addition, the cumulative hours are shown on the curves at levels 2, 4, 6, and 10.

Normal subjects. Subject 1 reached level-10 performance in 19 training hours with a

total of 84 trials of various kinds. Before the end of the first hour of training, this subject walked to the commode in response to the auditory signal and after the third hour he lowered his pants and took the appropriate stance. The first urination event in the commode occurred during the fourth hour of training. At the beginning of the thirteenth session, the auditory device was removed and, in addition to the cotton briefs, the subject was clothed in a pair of overshorts and a shirt.

Subject 2 required 122 trials and 27 hr to attain level-10 performance. The plateau that occurred for Subject 2 at level 3 is representative of a difficulty this subject had in learning to lower his training pants.

Subject 3 was the only female subject. The experimenter had difficulty in conditioning this subject to remain seated on the potty chair for the time required. The difficulty is indicated by the number of trials between levels 5 and 6. The first elimination event in the commode occurred during the eighteenth hour of training.

Retarded subjects. Subject 4 reached level 10 on the one hundred and eighty-eighth trial after 17 training hours. The graph for this subject shows that he emitted level-6 responses for a lengthy period of time. Low density of eliminations, which kept Subject 4 at level 6, was corrected by offering the child greater quantities of liquid. The first voiding event at the commode occurred during the ninth hour of training.

Subject 5 walked into the facility, removed pants, and stood appropriately in front of the commode after 3 hr of training. One hundred and fifty-seven trials at level 7 occurred before this subject voided in the commode. Twenty-two hours were required to reach criterion behavior.

Subject 6 had a hearing impairment and a partial paralysis of the left hand. Sounding the auditory signal prompted no observable response. Attempts to modify the device, in an effort to obtain a response, proved futile. By substituting a gentle tap on the subject's forehead, in place of the auditory signal, the training proceeded satisfactorily. The paralysis interfered with pants manipulation. This was corrected by clothing the subject in larger size pants which he could manage. This subject reached criterion in 30 training hours during which 262 trials were emitted.

Subject 7 was the only subject who failed to attain the performance required at level 10. After 19 hr and 379 training trials, this subject had acquired the behaviors of level 7. Frequent fluctuations between levels occurred. The experimenter observed that each voiding response was limited to a few drops of urine. Increasing the child's liquid consumption tended to increase the frequency of urinations without influencing their volume.

Subject 8 spent the major portion of the training sessions sitting motionless, with legs crossed, on the floor. A total of 436 trials spaced over 48 hr of training were required before Subject 8 demonstrated the behavior sequence required at level 10. To teach this child the first step of the toileting chain, namely to walk to the lavatory in response to the auditory signal, required 168 trials.

During urination training at level 7, Subject 8 did not consume enough liquid to void; and, in consequence, a diuretic drug was introduced. The drug, a polythiazide, was prescribed by the family's physician and was administered by the parent 1 hr before each session. A 2-milligram tablet increased the number of urinations but it also caused the subject to regurgitate. Reducing the dose by half eliminated the regurgitating without materially reducing the frequency of voiding.

Criterion Test Sessions

Over the three days of test sessions, the seven subjects emitted 90 perfectly performed responses and four error responses.

Follow-Up Sessions

The parent of one subject from each of the two groups was selected to provide information on the child's progress in the home. This period extended for six months after the formal experiment terminated. The parent of Subject 2, a normal child, reported that this subject eliminated in places other than the commode approximately four times per week during the first post-training month. During the next five months, errors decreased and by the end of the sixth month, Subject 2 averaged only one inappropriate response per week. More importantly, these "accidents" generally occurred when the child was playing out of the house or on a family outing.

Subject 8 was a profoundly retarded boy. At the end of the first month, the parent re-

ported that this child averaged four inappropriate responses per week. This average did not decrease during the remaining five months. At the end of the sixth month, the experimenter visited the home and observed the child for a period of 3 hr. The experimenter observed that the parent had begun to prompt the subject to go to the lavatory. Consequently, during the periods when the parent was not present to prompt the child, he did not move to a toilet before urinating. Admonitions to the parent to stop prompting had no effect on the parent's behavior.

DISCUSSION

Complete toileting behavior includes a complex chain of behaviors. However, the authors' review of literature revealed that researchers have been concerned primarily with the eliminative aspect of this chain. Since the occurrence of reflex voiding is difficult to predict, persons studying toilet behavior have concentrated their efforts in devising reliable procedures for detecting eliminations and reinforcing the proper ones (Dayan, 1964; Baumeister and Klosowski, 1965; Hunziak, Maurer, and Watson, 1965; Giles, and Wolf, 1966).

Ellis (1963) is frequently cited for having suggested a procedure for determining a child's "natural" eliminatory behavior, and using this information in setting up a schedule for placing the child on a toilet. Giles and Wolf (1966) used this suggestion in training mentally retarded children. On the other hand, Van Wagenen *et al.*, (1969) suggested that training take place only when the child is actually in the process of eliminating. Immediate detection of an event was possible by equipping each child with a urine-sensing auditory signalling device.

The purpose of this study was to investigate a procedure that deferred elimination train-

ing until the child had learned to walk to the commode, lower pants, and assume the sex appropriate stance. The results indicate that the method was effective in training seven of the eight subjects. Acquisition data for each child were not limited to elimination training, but obtained for the entire chain of toilet behavior.

Economic consideration of time and effort will not be ignored by those managing institutions for the retarded. Long waiting vigils in anticipation of urinary events are uneconomical and destructive of the motivations of caretakers. Prior training in which high density of practice trials can be carried out without dependence on physiological states can avoid some of these difficulties, as this study has shown. Slight procedural change and less elaborate equipment would make the method usable by a parent in the child's natural home.

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