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STIMULUS SELECTION AND TRACKING DURING URINATION: AUTOSHAPING DIRECTED BEHAVIOR WITH TOILET TARGETS[1]

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A simple procedure is described for investigating stimuli selected as targets during urination in the commode. Ten normal males preferred a floating target that could be tracked to a series of stationary targets. This technique was used to bring misdirected urinations in a severely retarded male under rapid stimulus control of a floating target in the commode. The float stimulus was also evaluated with nine institutionalized, moderately retarded males and results indicated rapid autoshaping of directed urination without the use of verbal instructions or conventional toilet training. The technique can be applied in training children to control misdirected urinations in institutions for the retarded, in psychiatric wards with regressed populations, and in certain male school dormitories.

DESCRIPTORS: autoshaping, toilet training, urination, stimulus control, natural reinforcers, recording and measurement techniques, retardates

The folklore and observational accounts of human male urination are replete with examples of focused responding on selected target stimuli in the immediate elimination environments. In the commode, such targets have traditionally included paper refuse, cigarette butts, insoluble dirt, imperfections in the basin porcelain, as well as various insects (including the proverbial "fly on the toilet seat"). In natural outdoor environments, respondents report (Siegel, unpublished data) that urination is also frequently marked by target selection including trees, bushes, twigs, stones, and leaves. Even when no targets are available, the urine stream itself is often manipulated to create various patterns. Despite the near universal nature of these accounts, no studies have investigated stimulus selection in these situations.

Such an inquiry may lead to the development of suitably attractive targets that might serve as distinctive cues in operant training procedures designed to bring urination under control when responding is inappropriate, as in enuresis, in institutions for the retarded, in certain psychiatric wards where the population is somewhat regressed, and in certain male school dormitories Previous methods for treating urination problems using positive reinforcement have been both effective (Azrin, Sneed, and Foxx, 1973; Giles and Wolf, 1966) and rapid (Azrin and Foxx, 1971; Foxx and Azrin, 1973*a*). Some methods have even employed signalling devices in the commode itself (Azrin, Bugle, and O'Brien, 1971; Litrownik, 1974; Watson, 1968) and/or special reinforcement devices in the commode environment (Hundziak, Mauer, and Watson, 1965). But all such methods involve a separation between cue and response, which can often impair discrimination learning (*cf.* Stollnitz, 1965). When cue and response are minimally separated, or parts of an integrate whole, learning is more rapid and autoshaping can occur (Hearst and Jenkins, 1974). Thus, the use of target control in urination has the potential advantage of providing an autoshaping procedure

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and thus being more efficacious in terms of time, cost, and training. In addition, the tracking of such selected stimulus targets, as is often found in other types of discrimination learning (Siegel, Note 1) could also help shape appropriately directed urinations when responding is not yet under strong stimulus control or under control of inappropriate stimuli such as toilet seats, walls, or floors.

Indeed, Kira (1966) argued that the serious soiling problems associated with misdirected urinations are the result of the dispersal characteristics of the urine stream coupled with the "poor target" presented by the normal commode (p. 142). Kira's analysis of the physics of urination and the design architecture of commodes suggested that the bowl water was the "easiest and most natural target" but the noise and splash associated with hitting this area resulted in most males avoiding it and directing the stream to the side and back walls. Kira further acknowledged that directed control to these relatively limited target areas is impaired in certain clinically ill populations but some soiling of self or surroundings is common for most males. Accordingly, this misdirected urination behavior might be modified by use of a feature "which would serve as a target in the critical area. This might conceivably be [a] ridge . . . or possibly some very obvious marker set in the surface" (Kira, 1966, p. 148). The following investigation was designed to evaluate the use of such targets for modifying misdirected urinations.

PRELIMINARY STUDIES

Stimulus Selection

A closed-circuit video camera equipped with a zoom lens was installed in a private men's toilet facility located in the Neuropsychiatric Institute at the University of California at Los Angeles. The camera was mounted on the ceiling directly above the toilet bowl, and its field of view was centered on the bowl but included the surrounding area as well (but not the subject). Ten volunteer male subjects, 21- to 30-yr old, who worked in the Institute and were all heavy coffee drinkers, were asked to participate in a study of urination patterns associated with coffee ingestion. They were told about the camera monitoring and asked to use the private toilet facility throughout the day for urination only. Two male observers located in an adjacent room watched a video monitor and were instructed individually to record frequency, duration, and response location during each urination. The observers were visually separated from each other by a cloth screen, although no acoustical shielding was provided. A small relay rack equipped with 28-V counters and digital timers was used for data collection. Observers operated a small push-button keyboard that activated timers and counters.

Urination behavior was scored according to the following procedure. Each entry into the toilet and start of urination was scored as a frequency of one. When urination began, the observer started a timer that recorded the duration of the entire urination episode, terminating when the urine stream or "dribble" was no longer visible. Separate timers and counters recorded the duration and frequency of urine stream contact (hits) with each location listed: bowl water, side wall, rear wall, seat area and any area outside the bowl, each of four target stimuli when present (see below). Thus, one urination incident could be subdivided into several locations, and separate frequency and duration measures were obtained for each location. Each change in urine stream location within a single urination episode was scored separately.

Baseline data were collected for 5 hr each day (8:00 a.m.-12:00 p.m., 1:00 p.m.-2:00 p.m.) for 30 days followed by 12 test days. On each test day, four targets were available in the bowl. Three stationary targets were painted 10 cm apart on the porcelain at the rear of the bowl just above the water line. These included the following stimuli: (1) a black circle, 1.25 cm in diameter; (2) a white circle, 1.25 cm in diameter; and (3) a "bullseye", 1.25 cm in diameter and composed of three concentric circles. The

Table 1

Mean urination response frequency and duration for each baseline and target condition for each subject (duration in seconds).

	Baseline-Rear		*Black Circle*		*White Circle*	
Subject	*Response*	*Duration*	*Response*	*Duration*	*Response*	*Duration*
1	0.75	3.1	0.50	2.2	0.08	3.0
2	0.50	2.0	0.25	0.8	0.00	0.0
3	0.08	0.5	0.16	1.2	0.00	0.0
4	0.33	2.6	0.66	6.2	0.25	6.1
5	0.75	8.3	0.91	9.0	0.58	4.4
6	0.25	7.1	0.91	7.1	0.41	5.1
7	0.16	6.2	0.66	8.3	0.16	7.0
8	0.41	3.5	1.25	10.1	0.16	3.8
9	0.66	4.4	0.83	6.1	0.08	5.8
10	0.91	5.2	1.16	5.0	0.25	1.8
MEANS	0.480	4.29	0.729	5.60	0.197	3.70

	Bullseye		*Baseline-Water*		*Float*	
Subject	*Response*	*Duration*	*Response*	*Duration*	*Response*	*Duration*
1	0.41	3.0	0.75	8.1	1.25	13.8
2	0.25	1.1	0.33	16.4	0.66	1.1
3	0.08	1.2	1.08	1.1	0.58	1.3
4	0.33	5.8	0.83	5.3	1.08	12.1
5	0.58	4.9	1.25	12.2	1.50	22.2
6	0.25	6.6	0.83	14.0	1.16	20.3
7	0.50	5.5	1.08	6.5	1.16	10.3
8	0.50	8.3	1.25	8.6	1.75	16.2
9	0.75	5.6	0.50	13.0	1.83	18.0
10	0.66	3.0	0.58	9.2	1.33	15.1
MEANS	0.431	4.50	0.848	9.44	1.23	13.10

positions of each of these stationary stimuli were randomly varied between test days by repainting. The fourth target consisted of a balsa wood float 1.25-cm diameter, which was painted with black and white stripes and allowed to float freely in the bowl. A nylon line secured the float to the toilet itself.

Throughout the study subjects had no contact with observers, but they occasionally questioned the experimenter about the purpose of the targets. The experimenter declined to give any comment on the targets until the study was completed. During the baseline period, subjects made a total of 520 urinations (mean of 1.7 urinations per subject per day) with a mean duration of 18.1 sec, which agrees with the range reported by Kira (1966, p. 145). Correlation between observers' scores for baseline were $r = 0.98$ for frequency, $r = 0.92$ for duration, and $C = 0.67$ for location.

During the test period, subjects made a total of 228 urinations (mean of 1.9 urinations per subject per day) with a mean duration of 16.7 sec. There were no significant differences between baseline and test urination frequency or duration for individual subjects (t-tests). Table 1 presents the frequency and duration of target hits during the block of 12 test days. Data are presented for individual subjects in terms of mean number of target hits per urination and mean total duration of urination on that target. Two different baseline data sets are also included: Baseline-Rear refers to urination during baseline directed at the rear wall of the bowl, just above the water line. These baseline data can be compared to the sationary target data, since such targets were located in the same area. Baseline-Water refers to urinations during baseline directed at the bowl water, and this can be compared to the data on the float target, which was located in the same general area. Table 1 shows dramatic changes in urination location when the targets were introduced. Repeated measures analyses of covariance on rear wall targets (black, white, bullseye) using Baseline-Rear data as the covariates showed significant treatment effects with frequency ($F = 19.946$, $p < 0.000$) and duration ($F = 5.616$, $p < 0.013$). Using the same data sets, analyses of covariance tests between black and white showed significant effects on frequency ($F = 32.244$, $p < 0.000$) and duration ($F = 7.468$, $p < 0.023$); between black and bullseye showed significant effects on frequency ($F = 12.800$, $p < 0.006$) and duration ($F = 5.141$, $p < 0.050$); and between white and bullseye showed significant effects on frequency only ($F = 9.654$, $p < 0.013$).

When the float data were compared with Baseline-Water, there were significant changes in frequency of urination ($t = 2.58$, $p < 0.03$) but not in duration ($t = 1.69$, $p = 0.125$). However, when the average of the rear-wall targets was compared with the float target in analyses of variance, there were highly significant differences in both frequency ($F = 91.415$, $p < 0.000$) and duration of urination ($F = 24.359$, $p < 0.001$).

In summary, these data indicate that introduction of targets did not change the overall number of urinations per day or their mean durations. However, the location of urination responses did change with target introduction, and there were significant differences in urination response frequency and duration between targets. The float was clearly the preferred target in both response and duration measures. Indeed, the mean duration of float responses was surprisingly greater than the average baseline (water) duration or the duration on any given stationary (rear) target. This latter result further supports the interpretation that the float was the preferred stimulus. Furthermore, observers recorded that the float was the first stimulus hit in 82% of the urinations.

Case Study

As a preliminary study of the clinical application of these findings, a single case was studied for 2 yr. Patient JR was a severely retarded 15-yr-old male with a history of micturition coupled with wetting of toilet seats, floors, and walls. During a series of interviews in the Institute, JR had to urinate several times and was escorted to the test toilet facility, which was vacant of target stimuli. A single observer timed and recorded behavior via the video monitor. Here, JR wet the seat and outer bowl with little directed responding to the water in the bowl itself. A single float was painted blue, JR's favorite color, and installed in the bowl. When JR once again indicated a need to urinate, he was escorted to the toilet and simply asked to try to hit the little blue ball. Within that single trial, 61% of urination time was directed at the float target or nearby bowl water compared with only 10% of previous urinations directed at these same areas. An identical float was installed in JR's home toilet, and he was simply reminded when he went to urinate "to try to hit the little blue ball". No additional positive or negative reinforcement was given. The parents were requested to examine the bathroom after each urination to check for urine puddles on the seat, walls, and floor, and to record these observations on daily log sheets. Within three days, JR's parents reported that there was no problem with misdirected urination in the commode environment itself, although there was some wetting of corners in the bedroom, especially at night. After initiating a regular procedure of changing the color (red, green, yellow, *etc.*) and shape (cube, cylinder, *etc.*) of the float every day to enhance target novelty and attractiveness and avoid target habituation, the parents reported that after six days there was no wetting outside the commode room itself. However, during nighttime urinations there remained some wetting of the toilet seat despite the use of a special night-light focused on the float target. To enhance further target visibility and distinctiveness, a special float was used. This special float consisted of a 1.25-cm diameter hollow translucent plastic sphere filled with a chemical luminescent mixture (Edmund Scientific Co., Barrington, New Jersey, No. P-60,923). After this float was installed, nighttime urinations were entirely directed at the float or surrounding water, with no wetting of other areas. A followup study at one, three, and six months revealed no relapse to previous misdirected responding. All targets were removed at six months and a 12- and 24-month followup indicated maintenance of directed urinations.

Because of the preliminary, albeit apparently effective, nature of this case study and the lack of control over observer (parent) reliability, a more formal evaluation was conducted.

METHOD

Subjects

Nine moderately retarded institutionalized males, 8 to 14 yr of age with a mean I.Q. of 53.7, had lived in the institution for an average of seven months, and together on the same ward. Three males (Chuck, Phil, Bert) had a past and current history of micturition and misdirected urinations and were designated "experimental" subjects. The remaining six males, having no present history of urination or other toilet problems, were designated "control" subjects (Terry, Paul, Henry, Bob, Mike, and Charles). Informed consent for the study, including video monitoring of toilet behavior, was obtained from parents or guardians of subjects.

Toilet Facilities

The ward contained a single bathroom equipped with two commodes (A and B) located in separate adjacent stalls. A video camera with a wide-angle lens was installed on the ceiling over the two commodes, permitting a clear view of both bowls and surrounding area, as well as the occupant. The large visual field was necessary to view the wide range of misdirected urinations manifested by these subjects.

Procedures

When a subject entered the commode environment, a buzzer activated by the opening of the bathroom door alerted an attendant-observer, who then entered an adjacent monitoring room equipped with a television monitor connected to the camera. The observer recorded the frequency, duration, and location of standing urination behavior using a clipboard equipped with data sheets and eight stopwatches. The scoring procedure was similar to that described in the preliminary study. The response locations scored were: (1) any area inside the toilet including bowl water, and walls, but excluding the float target when it was present; (2) the float target; and (3) any area outside the bowl including the seat, floors, and walls. Thus, any single urination episode could be subdivided into several locations with separate frequency and duration measures for each location. Sitting toilet behavior was not monitored. Three different student observers (male) were used throughout the study, although behavior was scored by only one observer at any given time. All observers were trained together on two separate days for a total of 16 hr of observation. Mean correlations between observers' scores during this period were $r = 0.97$ for frequency, $r = 0.93$ for duration, and $C = 0.88$ for location. All observers were retrained for 4 hr on Day 60 and mean correlations between their scores for this period were $r = 0.93$ for frequency, $r = 0.95$ for duration, and $C = 0.80$ for location.

Commode behavior was monitored daily in this way from 7:00 a.m. to 11:00 a.m., 3:00 to 5:00 p.m., and 6:00 to 8:00 p.m. All subjects had access to both commodes. Baseline data were collected for seven days followed by the introduction of a permanent float target on Day 8. The float was identical to the black and white striped wooden float described previously and was installed in only one commode bowl (A). Subjects were given no instructions regarding

Table 2

Mean number of standing urinations per day in each commode throughout study. Baseline—mean for Days 1 to 7; Target In (A) = mean for Days 7 to 49; Target Out—mean for days 50 to 56; Target In (B) = mean for days 57 to 75; Instructions = mean for days 76 to 120. Asterisk (*) designates target commode.

	Baseline		*Target In (A)*		*Target Out*		*Target In (B)*		*Instructions*	
Subjects	*A*	*B*	*A**	*B*	*A*	*B*	*A*	*B**	*A*	*B*
Chuck	3	2	4	1	4	2	3	5	1	5
Phil	0	4	2	3	0	5	0	4	0	4
Bert	1	4	6	1	3	3	1	5	0	5
Terry	2	0	2	0	2	0	2	1	1	1
Paul	4	2	3	0	2	1	0	3	0	4
Henry	0	4	3	1	1	2	0	3	0	3
Bob	1	1	2	0	1	1	0	3	0	2
Mike	2	1	3	0	2	1	1	2	1	2
Charles	0	2	0	2	0	2	0	2	0	2
Totals	13	20	25	8	15	17	7	28	3	28
% Total	39.39	60.61	75.75	24.25	46.87	53.13	20.00	80.00	9.70	90.30
% Misdirected	10.17	24.43	8.44	2.96	6.30	8.80	1.15	3.38	0.18	1.74

the float, and attendants answered questions concerning the float or camera by simply stating "it's a new part of the toilet and we want to study it". Behavior continued to be monitored daily through Day 15 and then at weekly intervals on Days 22, 29, 36, 43, and 49. On Day 50, the float target was removed and behavior again monitored daily through Day 56. On Day 57, the float was installed in the other commode (B) and daily monitoring continued on Days 57 to 60, and 75. On Day 76, all residents were given verbal instructions to "try to hit the floating ball as often as you can", and attendants repeated the instructions periodically throughout daily monitoring to Day 79. No instructions were given after that time, and behavior was monitored again on Days 90, 105, and 120.

Throughout the study, including baseline days, additional fruit juices and other fluids were made available to all residents in order to increase the frequency of urination. Residents were not required to clean up any misdirected urine traces either in the bathroom or ward.

RESULTS

Figure 1 presents daily misdirected urinations for each experimental subject and means for the control subjects in terms of the mean per cent duration (in seconds) of total daily urinations. Total urinations in both commodes have been used as the data base here, since residents manifested strong preferences for individual commodes, as well as low frequencies and durations of standing urinations. Misdirected urinations were computed from observer scores according to the following formulation: the total duration of urinations located outside the bowl area was divided by the total duration of the entire urination episode (sum of all locations) and multiplied by 100 to give the per cent of misdirected urinations. This figure was computed daily for each subject. Table 2 presents the results for each resident in terms of the mean number of standing urinations per day in each commode throughout different phases of the study. Table 2 also shows the distribution of misdirected urinations for all subjects in each commode.

Baseline Behavior

During baseline days, the three experimental subjects directed their urinations at the bowl water or inner surfaces of the two commodes for 66.9% of the time, thus accounting for 33.1% misdirected urinations (Figure 1). Chuck's graph in Figure 1 shows an average 40.4% misdirected

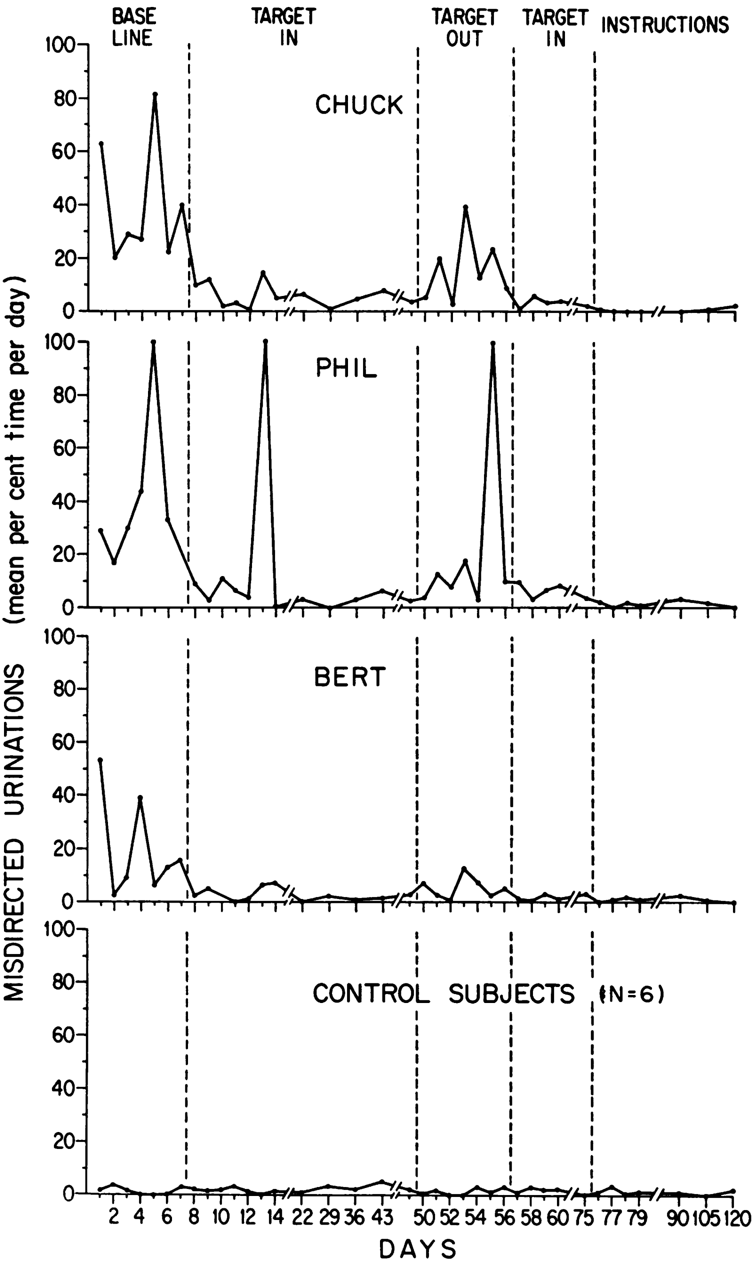

Fig. 1. Daily misdirected urinations for each experimental subject and means for control subjects in terms of the mean per cent duration in seconds of total daily urinations for both commodes. Days 1 to 7 = Baseline; Days 8 to 49 = Target In (commode A); Days 50 to 56 = Target Out; Days 57 to 120 = Target In (commode B); Day 76 = Instructions started. The dotted lines designate the start of the first day in which each phase started. For example, the target was first introduced on Day 8 (marked Target In), and the data plotted for Day 8 represent the first daily data set for this phase.

urinations over the seven baseline days; the data for Phil and Bert indicate 39.1% and 19.7% misdirected time, respectively. Most of these misdirected urinations consisted of wetting the seat, floors, and surrounding areas. Such misdirected responses were distributed throughout commode visits, and once a resident started wetting an area, few attempts at manipulating the stream to other areas were observed. On Day 5, Phil made only one recorded standing urination and this was totally directed at the outside rear of the commode fixture.

The control group directed urinations at the bowl water or inner surfaces of the commodes for 98.5% of the total standing urination time. The remaining average 1.5% time during which misdirected urinations were recorded for Days 1 to 7 (Figure 1) consisted of mostly wetting the seat or self. These misdirected responses were distributed at the very beginning or very end of a specific urination episode and appeared to be true "accidents". These accidents were attributable to temporary and unnoticed dermal adhesions of the urethal opening at the start of urination and to the rapidly changing trajectory of the urine stream at the end of urination (*cf.* Kira, 1966, p. 142).

Table 2 indicates the strong individual preferences for commodes during baseline days. As a group, residents used commode A 39.4% of the time and B 60.6% of the time for standing urinations. Observers also noted that similar preferences were shown for bowel-movement behavior in the commodes, although accurate records of these latter behaviors were not kept. The relatively low frequency of standing urination behavior can be attributed to many of the residents' having been previously toilet trained to urinate in a sitting position.

Target Behavior

After installation of the target in commode A on Day 8, there was a dramatic shift in commode preference, as indicated by Table 2. During Days 8-49, residents used the target commode 75.8% of the time. The target itself was hit on 91.1% of these urinations. Concomitantly, misdirected urinations were reduced in duration for the three experimental subjects (Figure 1). Chuck showed a reduction in misdirected urination time from a baseline average of 40.4% to an average of 6.7% over Days 8 to 14. Similarly, Phil's misdirected urinations dropped in time to 19.0% and Bert's decreased to 3.4% for this same period. Interestingly, Phil made only one recorded standing urination on Day 13, which was totally directed against the rear wall of commode B. Control subjects showed no change in misdirected urinations on Days 8 to 14 (average 1.7%), although they did show a strong preference for the target commode (Table 2) and hit the target on 83.2% of urinations in that commode.

When the target was removed for Days 50 to 56, Chuck, Phil, and Bert all showed some increase in misdirected urinations, while controls remained unchanged (Figure 1). Chuck had the largest increase in misdirected urination time, averaging 16.0% during this period. On Day 55, Phil once again had a single standing urination totally directed at the rear wall of commode B. Throughout this "Target Out" phase, residents used both commodes equally often (Table 2).

The target was installed in commode B on Day 57 and this resulted in a dramatic preference by residents for that commode (80.0%, Table 2), while target hits stayed at 90.7% for all residents. Although the three experimental subjects showed some decrease in misdirected urination time during Days 57 to 75 (Figure 1), these times still did not decrease to levels found for control subjects. Indeed, because of the rigid criterion for scoring misdirected urinations, which included "dribble" at the end of urinations, even the control subjects rarely demonstrated completely directed standing urinations.

Accordingly, verbal instructions to hit the target began on Day 76, and this resulted in a 90.3% preference for target commode B (Table 2), virtually eliminating standing urination behavior in the other commode. Residents hit the target on 94.1% of the urinations in this commode. Concomitantly, Figure 1 clearly shows that for Days 76 to 120, misdirected urination time decreased to averages of 0.71% for Chuck, 1.6% for Phil, and 1.07% for Bert. Control subjects showed no further reduction in misdirected urinations with these verbal instructions.

Generalization

Table 2 also shows the distribution of misdirected urinations for all subjects in each commode throughout different phases of the study. During baseline, 24.43% of the urinations in commode B were misdirected; 10.17% of urinations in commode A were misdirected. When the target was placed in commode A, misdirected urinations there decreased to 8.44%. Concomitantly, misdirected urinations decreased to 2.96% in commode B where no target was present. When the target was removed for Days 50 to 56, misdirected urinations increased slightly in both commodes but remained below baseline levels. Target installation in commode B shifted most urinations to that commode, where 3.38% were misdirected. While the target remained in commode B, misdirected urinations in A dropped to 1.15%. During the instruction period, misdirected urinations further decreased for both the target commode B (1.74%) and commode A (0.18%). Taken together, these data strongly suggest that target control over misdirected urination generalized to the adjacent commode where no target was present.

Reactions of Residents

During baseline, residents frequently oriented toward the camera while seated on the toilets, but they did not attend to the camera during standing urinations. When the target was first noticed on the morning of Day 8 (it had been installed at 3:00 a.m. that day while the residents were asleep), considerable excitement was generated among some residents. Residents rapidly shifted elimination behavior to the target commode and appeared to derive pleasure from hitting the float with the urine stream. During the course of this investigation, the target had to be replaced several times due to corrosion and, on one occasion, when it "disappeared" from the nylon anchor line. The initial excitement appeared to habituate over time, but when the target was removed for Days 50 to 56, residents spent considerable time looking for it upon each visit to the bathroom, often inspecting each commode before selecting one for use. This behavior could account for the relatively equal use of both commodes during this period.

When the target was installed in commode B on Day 57, residents appeared extremely pleased and were eager to show the target to other residents as well as to staff. When verbal instructions were finally given on Day 76, residents manifested increased interest in the target and started standing considerably closer to the commode in order to urinate more accurately. This change in body position could partially account for the accompanying reduction in misdirected urinations (*cf.* Kira, 1966). In addition, during the instruction period, residents appeared to make a game of hitting the target, and several times two residents were observed urinating simultaneously at the target. The use of additional stopwatches enabled observers to record individual behaviors here. (We have found observers can handle up to eight stopwatches efficiently, but no interobserver correlations were obtained here.)

DISCUSSION

The most apparent aspects of these results are: (1) normal males selected and tracked a stimulus target during urination, a phenomenon heretofore only anecdotally reported; and (2) a floating target was used to bring misdirected urinations in retarded males under rapid stimulus control.

In the single case study, patient JR, when instructed to urinate on the target, directed most urinations in the commode to the target area within three days. Misdirected urinations outside the commode environment quickly decreased as the commode target's visibility and distinctiveness were enhanced. Misdirected urinations rapidly decreased to zero and remained near zero through a 24-month followup, with all targets removed at six months. In the formal ward study, three moderately retarded males with problems of misdirected urinations showed rapid acquisition of directed responding in one commode as soon as the float target was installed. This occurred without the use of verbal instructions or other training procedures. Although these subjects preferred to use the commode equipped with the target, directed urinations generalized to an adjacent commode that did not contain a target. Removal of the target after 50 days resulted in some loss of stimulus control for two subjects, while subsequent installation of the target in the other commode re-established directed responding. The use of verbal instructions to hit the target appeared to decrease misdirected urinations further, although the experimental design does not allow for confirmation of this finding as sequence effects may be a confounding factor. Six other retarded males on the ward, with no problems of misdirected urinations, showed a dramatic preference for the target commode and directed their urinations at the floating target.

While more experimental analysis is needed to specify the precise stimulus-reinforcer relationship here, as well as the underlying motivation to urinate on targets, the potential for applied clinical use is apparent. The use of a float target for rapid control of directed urinations represents a practical, economical, and standardized technique. The method has the obvious advantage over others in reducing staff time by eliminating the need for verbal instructions or conventional training. The method does not involve negative reinforcement and apparently utilizes the organism's natural biological responses to environmental conditions. Both normal and retarded males enjoyed responding at the targets and appeared to derive much pleasure from successful tracking of the float target. Similar targets could thus be incorporated into the design of urinals or commodes used by both types of populations. Nonetheless, the method is limited to modifying standing urination behavior and could not be used for misdirected urinations that occur when a subject is seated on the toilet or is not in the commode environment. In the latter case, more common-sense cleanliness procedures would be warranted (*cf.* Foxx and Azrin, 1973*b*). Another limitation is the rapid habituation to the target that may occur in some individuals, as it did in patient JR. Here it is likely that the target would have to be a constantly varied yet permanent feature. For such cases, we have found that the use of commercial fishing lures and casting flies provides suitable stimuli, which are both waterproof and varied.

Historically, ethologists and zoologists have related target selection for urination and defecation to odor and territorial scent-marking (Doyle, 1975; Morris, 1967). Such considerations seem irrelevant to modern commode behavior, where targets are still utilized or else the urine stream itself is manipulated. The preferred selection of the float over other stationary targets would seem to support the speculation that such targets and tracking are intrinsically reinforcing, perhaps due to the object manipulation the targets signal and the tracking provides. Organisms are known to orient toward, approach, and frequently contact such targets when they are positively reinforcing signals. The selection and tracking of the float target appears to be a special case of this behavior, which is known as "sign-tracking" and "refers to behavior that is directed toward or away from a stimulus as a result of the relation between that stimulus and the reinforcer" (Hearst and Jenkins, 1974, p. 4).

Sign-tracking is more commonly known as *autoshaping,* a term coined by Brown and Jenkins (1968) which is particularly descriptive of the present procedure in that the training is automatic (does not require the experimenter's presence or attention) and causes subjects to perform the operant response (*e.g.,* urination on target) without any instructions or conventional training. Accordingly, sign-tracking steers the organism to the site of the reinforcer if the source of the signal and the object happen to be in the same place (*cf.* Hearst and Jenkins, 1974, p. 3). Thus, urination may have been directed to the target in the present study, where signal and object were related. Such stimulus-reinforcer relationships are not unique to urination. A sign can also function in a conditional relation as an occasion for a response to some other feature of the environment. This is the case when contact with warm water or the sound of running water elicits an urination response in babies and young children (Hurlock, 1937; Spock, 1946), and when drinking fluids while seated on the toilet facilitates elimination behavior in conventional toilet-training programs (Foxx and Azrin, 1973*b*).

The previous methods for modifying urination (see Introduction) involve a separation between sign (cue) and response, and this separation reduces the efficacy of discrimination learning. When sign and response were part of an integrated whole as in the present study, autoshaping was possible. The notion that the float stimulus was such a distinctive sign with intrinsically reinforcing responses when hit (*e.g.*, object manipulation) may account for its selection, tracking, and rapid acquisition of stimulus control during urination in the present study.

REFERENCE NOTE

1. Siegel, R. K. *Discrimination learning between and within complex displays.* Unpublished doctoral dissertation, Dalhousie University, 1970.

REFERENCES

Azrin, N. H., Bugle, C., and O'Brien, F. Behavioral engineering: two apparatuses for toilet training retarded children. *Journal of Applied Behavior Analysis,* 1971, **4,** 249-253.

Azrin, N. H. and Foxx, R. M. A rapid method of toilet training the institutionalized retarded. *Journal of Applied Behavior Analysis,* 1971, **4,** 89-99.

Azrin, N. H., Sneed, T. J., and Foxx, R. M. Dry bed: a rapid method of eliminating bedwetting (enuresis) of the retarded. *Behaviour Research and Therapy,* 1973, **11,** 427-434.

Brown, P. L. and Jenkins, H. M. Autoshaping of the pigeon's key peck. *Journal of the Experimental Analysis of Behavior,* 1968, **11,** 1-8.

Doyle, G. A. Some aspects of urine-washing in four species of prosimian primate under semi-natural laboratory conditions. *Contemporary Primatology,* 1975, 232-237.

Foxx, R. M. and Azrin, N. H. Dry pants: a rapid method of toilet training children. *Behaviour Research and Therapy,* 1973, **11,** 435-442. (*a*)

Foxx, R. M. and Azrin, N. H. *Toilet training the retarded.* Champaign, Illinois: Research Press, 1973. (*b*)

Giles, D. K. and Wolf, M. M. Toilet training institutionalized, severe retardates: an application of operant behavior modification techniques. *American Journal of Mental Deficiency,* 1966, **70,** 766-780.

Hearst, E. and Jenkins, H. M. *Sign-tracking. The stimulus-reinforcer relation and directed action.* Austin: The Psychonomic Society, Inc., 1974.

Hundziak, M., Maurer, R. A., and Watson, L. S. Operant conditioning in toilet training of severely mentally retarded boys. *American Journal of Mental Deficiency,* 1965, **70,** 120-124.

Hurlock, E. B. *Modern ways with babies.* Philadelphia: J. B. Lippincott Company, 1937.

Kira, A. *The bathroom.* Ithaca: Cornell University, 1966.

Litrownik, A. J. A method for home training an incontinent child. *Journal of Behavior Therapy and Experimental Psychiatry,* 1974, **5,** 77-80.

Morris, D. *The naked ape.* Toronto: Bantam Books, 1967.

Spock, B. *Baby and child care.* New York: Pocket Books, 1946.

Stollnitz, F. Spatial variables, observing responses, and discrimination learning sets. *Psychological Review,* 1965, **72,** 247-261.

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