DAYTIME WETTING AND SOILING

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Incontinence of faeces and urine is one of the most common behavioural deficits found in the general community (Ross, 1972). Although it is a problem which has been recognized for centuries (Glicklich, 1951), the extent of the disruption and unhappiness which it can cause is largely hidden, because it is a topic which is avoided or ridiculed (Caldwell, 1975; Werry, 1973). Children's health and welfare services receive frequent requests from parents for help with toilet training, and there is considerable coverage of this topic in the professional and popular literature (Azrin & Foxx, 1974; Ilg & Ames, 1962; Pumroy & Pumroy, 1965; Spock, 1968; Werry, 1973; Wright, 1975). This chapter is concerned specifically with daytime incontinence that occurs with normal' and retarded children and has no organic basis.

Development of continence

The available evidence suggests that voluntary bladder and bowel control is a complex skill, gradually acquired in the early years of life, and involving neurological and physiological maturation (Muellner, 1960a, 1960b; Yates, 1970). As such, its acquisition takes some time, with an increasing success rate, and with occasional failures during acquisition. In addition, there are individual differences in the time taken to achieve final control. Bowel control at night is usually achieved first, followed by bowel control during the day soon after 3 years of age (Bellman, 1966; Stein & Susser, 1967). This is followed by the achievement of bladder control during the day (Werry, 1973), and, finally, bladder control during the night is acquired by about four years of age. A number of authors have outlined the developmental sequence of bladder control in detail (Bettison, 1978; Gershenfeld, 1943; Lovibond, 1964; Lovibond & Coote,1970; Mahoney, 1973; McGraw, 1940; Muellner,1958,1960a,1960b) and Yates (1970) suggests that the process is similar for bowel control. There are also a number of discussions in the literature of the physiological and neurological processes involved in bladder and bowel functioning (Basmajian, 1967; Caldwell, 1975; Schuster, 1968; Vincent, 1959, 1960, 1964, 1966; Yates, 1970).

Roughly 2 per cent of children between 6 and 12 years of age still wet during the day (Blomfield & Douglas, 1956; Hallgren, 1956; Lapouse & Monk, 1964). Little is known about the prevalence of soiling, except that it is less common (Bellman,1966).

Mentally retarded children are not included in these estimates. However, incontinence in this group is a major problem. Retarded children by definition develop more slowly than non-retarded children and acquire bowel and bladder control later (Carr, 1974). Over 25 per cent of children under 16 years of age and with an IQ of less than 50 are incontinent (Bayley, 1973; McCoull,1971). Incontinence is one of several factors determining both initial institutionalization of the retarded (Bayley, 1973) and the likelihood of discharge (Eyman, Tarjan & Cassady, 1970). Consequently, the majority of the incontinent retarded of all ages are in institutions and make up over 50 per cent of institutional populations (DHSS, 1972; Bayley, 1973; Tarjan, Wright, Dingman & Eyman, 1961).

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The nature of toileting

Although the development of continence appears to be a maturational process for most people (McGraw, 1940; Muellner, 1960a, 1960b), toileting in fact involves the acquisition of a complex set of behaviours, some of which occur as a series or chain, and some of which occur concurrently. In addition, it incorporates observable instrumental behaviours combined with internal muscle control. Although the outcome of this muscle control can be observed, its performance is not readily observable. Moreover, a number of fine discriminations are required with regard to environmental arrangements, clothing and its disposition on the body, and physiological sensations. The components and their sequence are shown in Figure 5.1. However, this complexity only becomes apparent when there is failure to acquire or perform some or all of the components of toileting and attempts are made to teach the skills which are lacking.

A further complication for training is the nature of untrained voiding, which is essentially respondent rather than operant, as Figure 5.2 indicates.

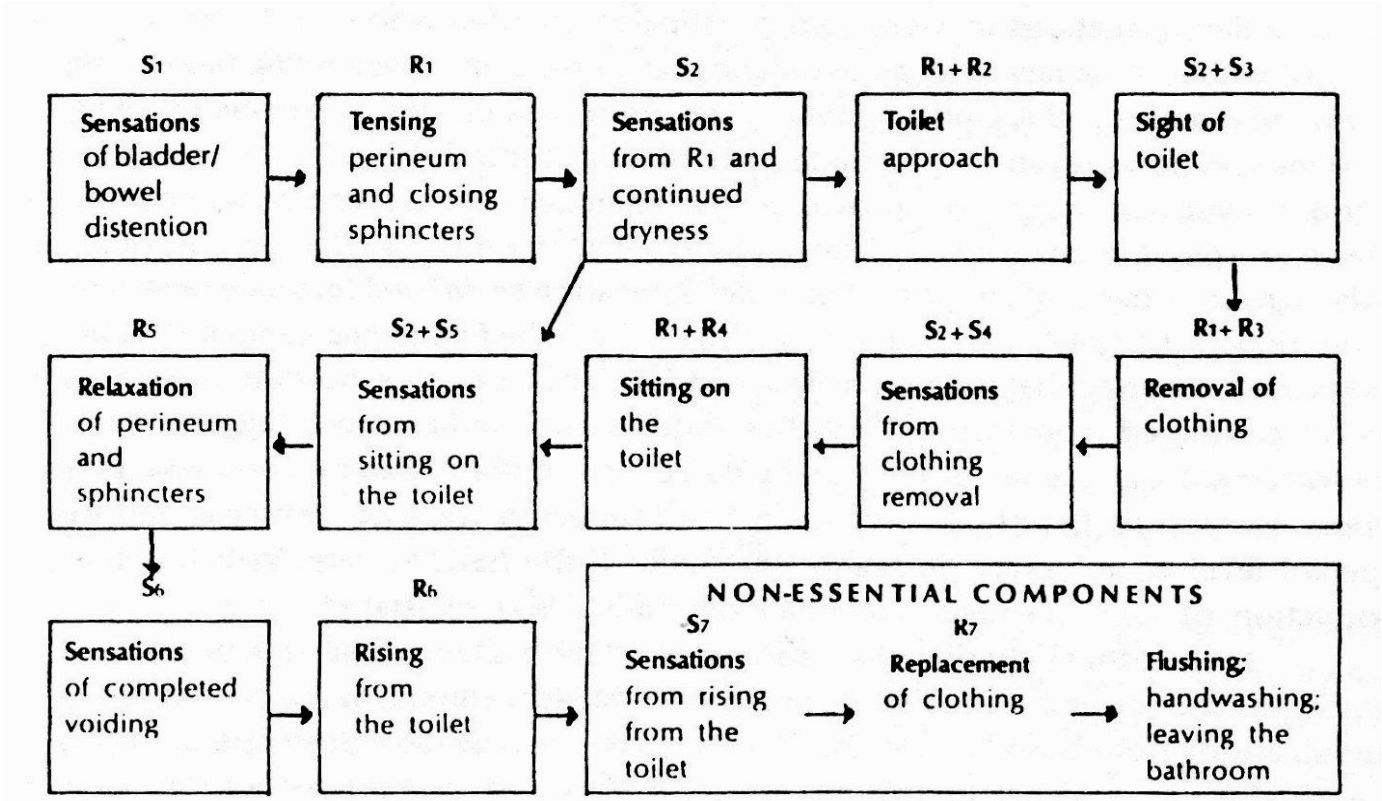

FIGURE 5.1 Schematic representation of the components of toileting

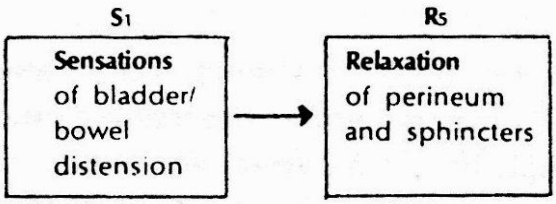

FIGURE 5.2 Schematic representation of reflex voiding

The process of bringing voiding under voluntary control inserts a number of operant responses between the initial eliciting stimuli of bladder or bowel distension and the reflex voiding response,

as well as bringing voiding itself under environmental control so that instructions and stimuli arising from toilet sitting can become discriminative stimuli for voiding in the absence of sensations of fullness (Muellner, 1960a,1960b). Because of the initial reflex nature of voiding it is possible that classical conditioning is at least partly involved in the development of mature voiding patterns. However, a thorough behavioural analysis of the development of bladder and bowel control is yet to be done. In the meantime, behavioural approaches to toilet training have invariably used an operant model.

Operant techniques in toilet training

Since 1960 there have been over eighty published papers describing the use of operant principles to establish toileting, and most of this work has been with normal and autistic children or retarded children and adults. While many reports are of individual or group case studies and many used relatively simple procedures, there has been a significant trend towards more complex and systematic programmes, especially for the retarded. Several reviews of toilet training studies with the retarded already exist (Osarchuk,1973; Rentfrow & Rentfrow,1969; Watson, 1967), but there has been little cross-fertilization of ideas between those working with the retarded and those working with normal children. The difference between these two groups in relation to toilet training can be seen in terms of the number of component skills which require systematic training, and this approach will be the major emphasis in this chapter.

Many studies have treated toileting as a single unit rather than as a complex skill. However, an examination of the behaviour changes involved suggests that successful subjects were usually already able to perform most of the toileting chain and only lacked one or two essential elements. This has been the case when constipation or encopresis was the presenting problem. Therefore, the following discussion first examines the treatment approaches dealing with toileting responses which are susceptible as a unit to behavioural control, and then follows with an analysis of toileting where many or all of the skill components require training.

Toileting as a unitary response

Three case studies have reported successful applications of positive reinforcement to induce toilet defecations in 3-year-old constipated children who had developed the habit of withholding faeces as an avoidance response after experiencing pain during bowel movements (Lal & Lindsley, 1968; Peterson & London, 1964; Tomlinson, 1970). All three children presumably had adequate bladder control. Suppositories, laxatives or quasi-hypnotic suggestion provided discriminative stimuli, additional to those already resulting from bowel distension, to elicit the first defecation responses. Although reinforcement contingent on toilet defecation continued for some time, daily defecation in the toilet was established virtually from the first reinforcement. The first two studies reported that this was maintained for eight months or more after treatment was discontinued. Tomlinson (1970) has added some validity to the suggestion that reinforcement was the factor controlling defecation in these studies. A reversal condition was accidently introduced during the fourteenth week of treatment and the operant level of voluntary defecation dropped to the baseline rate. With the reintroduction of reinforcement, voluntary defecation was reinstated.

Each of these children was required to attach a chain of toileting behaviours, which was already established in the presence of bladder stimuli, to the discriminative stimuli arising from bowel distension. Bowel tension was already clearly perceived by the children as a signal to tighten the sphincters and prevent defecation. Consequently, all the elements and links in the chain werewell established and presumably maintained by natural contingencies. The programmed reinforcer merely cemented the last connection, while allowing the avoidance response to decay, hence the speed of acquisition.

Soiling, or encopresis, presents a more complicated picture. It can be of several different types, which may determine the training procedures which are most effective. Some children simply have not developed voluntary control. Several reasons have been given for this type of soiling, including failure to incorporate the socially required toileting behaviours into the sequence of bowel control (Pedrini & Pedrini 1971), active avoidance of the toilet (Keehn, 1965; Neale, 1963), or sphincter impairment (Engel, Nikoomanesh & Schuster, 1974; Kohlenberg, 1973). Soiling can also be associated with retention of faeces so that, on physical examination, the colon is found to be enlarged and inactive and the anal sphincter open. This type is referred to as psychogenic megacolon in the literature, and involves loss of rectal sensation with soiling as a result of faecal overflow (Anthony, 1957; Coekin & Gairdner,1960; Woodmansey, 1967).

Four studies successfully dealt with older constipated children who had reached the stage where soiling was occurring as well. Presumably, the task of establishing appropriate toileting in these cases was complicated by both the suppression of bowel and sphincter reflexes, and the need to extinguish avoidance responses associated with defecation. In addition, many of the children no longer recognized the occurrence of bowel distension.

Ashkenazi (1975), Neale (1963) and Young (1973) all described children who either had experienced severe punishment for soiling as well as coercive toileting, or pain during defecation, or both. Besides providing positive reinforcement for toilet defecation, these authors introduced a number of procedures to reinstate reflex voiding and rectal sensations as discriminative stimuli for toileting. Faecal softners or suppositories were used to reduce pain and bring the stimuli from rectal distension into awareness, and toileting was required at times when reflex bowel contractions were most likely, usually after a meal. In addition, Ashkenazi (1975) instructed parents to first shape toilet sitting in children who avoided the toilet by rewarding successively nearer approaches and longer times on the toilet. Additional rewards were provided at bed time contingent on clean pants during the day. Ferinden & Van Handel (1970) treated a similar case with counselling in combination with aversive conditioning at school to establish toileting as an avoidance response.

Success was not as immediate in these four studies as in the three cases of constipation. Treatment time ranged from three weeks to over two years, with a few children failing to respond to treatment at all. Aversive conditioning did not appear to produce results which were different from those in the studies using shaping and positive reinforcement in combination with the maximizing of discriminative stimuli. However, none of these studies included experimental controls to evaluate the procedures used, and only Neale provided continuous quantitative behaviour measures. Although it is possible that long-term constipation and soiling may not respond as quickly as constipation alone to operant procedures, there are both practical and theoretical reasons for controlled studies which examine in more detail the process of bringing disturbed reflexes under voluntary control and the procedures which are most effective.

Two excellent studies have directly trained sphincter responses (Engel et al. 1974; Kohlenberg, 1973). Engel et al. (1974) treated six adults and a 6-year-old child who soiled. The adults had no history of constipation, while the child was not only constipated but had also required an ileostomy for urinary incontinence resulting from a neurogenic bladder. Physical examination showed that all subjects had diminished or entirely absent external sphincter responses. Kohlenberg (1973) treated a 13-year-old boy who had previously been unsuccessfully surgically treated for Hirschprung's disease, a congenitally dilated colon, and was being considered for a colostomy at the time of the study. This child also had inadequate sphincter tone.

Although the procedures for measurement and treatment differed in the two studies, both provided continuous measurement of sphincter responses by ingenious pressure devices inserted across the sphincter. These were attached to visible scales which recorded momentary changes in sphincter

pressure. Engel et al. (1974) inflated a rectal balloon to simulate distension by faeces while subjects watched the record of their sphincter responses. They were instructed to try to approximate a predetermined pressure reading and were rewarded for closer approximations. They were also encouraged to practise applying sphincter pressure during the three weeks between sessions. Once the target response was well established, reinforcement became intermittent in order to transfer control of the response from contrived to natural reinforcers. Kohlenberg (1973) followed a similar procedure without the eliciting stimulus of rectal distension and without conscious practice between sessions. Reinforcement in both studies consisted of praise and direct feedback from the pressure reading, as well as tangible rewards for the children. In addition, Kohlenberg alternated reinforcement and extinction conditions which provided powerful evidence that sphincter responses were in fact under the control of the operant contingencies.

The trainees in the study by Engel et al. (1974) completed training within four two-hour sessions. Four, including the child, became fully continent and remained so for follow-up periods of six months to five years. Incontinence was substantially reduced for a further two adults, and one adult withdrew from treatment because of pain from an anal fissure. Kohlenberg's subject took longer to reach the target response and soiling was not completely eradicated one month later, although it was substantially reduced. However, the rate of acquisition in relation to training time in both studies is impressive and indicates the value of directly teaching control of the physiological processes involved in bowel functioning.

Nine papers reported treatment for encopresis which, from the available information, appeared to result from a failure to insert R1, 2, 3 and 4, together with their accompanying cues (Figure 5.2), between the sensations of bowel distension and the act of voiding. All children were continent of urine.

Keehn (1965) and Pedrini & Pedrini (1971) used procedures similar to those used in the three studies of simple constipation described earlier. Defecation in the toilet with no soiling was established immediately, followed by gradually more intermittent reinforcement over a period of two or three months. Pedrini & Pedrini provided further follow-up evidence of success over seven months after training. Chopra (1973) followed a similar procedure with a mildly retarded boy with much slower results but with similar longterm success. If we assume that acquisition in retarded children takes longer than in normal children under the same conditions, then additional shaping procedures or consequences for several components of toileting should make learning easier and speed up the process. This was demonstrated in Wolf's study (1965). A moderately retarded boy was first rewarded for all toilet defecations. Within two weeks soiling had decreased markedly and he had begun taking himself to the toilet. Rewards were then made contingent only on self-initiated toilet defecations. Soiling immediately ceased and reward was gradually withdrawn. Final self-control of bowel functioning was established by giving the boy a pet which was withdrawn for a day if soiling occurred. The rewards were finally reinstated in unfamiliar settings to establish generalization across a wide variety of situations.

Marshall (1966) shaped the components of toileting in a hyperactive autistic boy who was afraid of the toilet. Punishment was contingent on soiling and masturbation in the toilet. Satisfactory results took longer to achieve than in Wolf's study but again demonstrate that bowel control can be established even in difficult subjects with direct teaching of the toileting components. Even without shaping, a more complex programme produced rapid results for another mildly retarded boy (Scott, 1977). Multiple reinforcements for both toilet use and clean pants, as well as punishment for soiling, led to an immediate drop in accidents. Over nine weeks the reinforcement schedule was thinned, the reward itself was reduced and finally transferred into the boy's classroom where he continued to toilet himself.

Edelman (1971), Houle (1974), and McDonagh (1971) reported much less dramatic results which

may have been due to the less direct relationship existing between toilet defecation and the consequences provided. Edelman (1971) made aversive consequences contingent on soiling rather than tackling toilet defecation directly as the behaviour requiring control. It took twenty-four weeks to reduce soiling to an acceptable level. Houle (1974) also followed soiling with an aversive event, but provided rewards for each half day of clean pants. Training continued fortwentyweeks with a gradual stretching of the reinforcement schedule. By the thirteenth week soiling had completely stopped and only three soilings occurred cluing a four month followup period. McDonagh (1971) had much less control over the contingencies even though direct reinforcement for toilet defecation, as well as for clean pants at the end of the day, was the initial procedure used. Staff at the institution did not stop reacting angrily and depriving the subject of outings when soiling occurred, and their cooperation with the reinforcement programme was reluctant. As a result, a number of procedural changes were made. Although soiling decreased markedly, the programme was stopped before the new behaviour could be firmly established.

A comparison of these nine studies suggests that directly strengthening toilet defecation in cases of psychogenic megacolon is more effective than either applying positive consequences which are only indirectly connected to toilet defecation, or delivering punishment for soiling. However, only controlled studies which compare the different procedures can establish whether this is so.

Three further case studies report treatment for soiling in non-constipated children whose reflex bowel functioning appeared to be disturbed. Both Gelber & Meyer (1965) and Logan & Garner (1971) used combinations of punishment for soiling and positive reinforcement for periods of no soiling, and both achieved lasting behaviour change within three months. In addition, Gelber and Meyer provided reward for toilet defecation. Their subject began to avoid punishment by hiding his soiled pants, and retained faeces when reward was made contingent only on clean pants. However, once toilet defecation was established, intermittent reward for clean pants was successfully used as a means for transferring behavioural control to natural contingencies. Rickard & Griffin (1969) only rewarded toilet defecation and did not achieve the immediate reduction in soiling found in other studies usingthis procedure. However, their control over the contingencies in the camp situation where the study took place may not have been complete. The child still soiled on his return home, although at a reduced rate.

Although successful acquisition of toilet defecation was achieved in these three studies, the initial problem, failure to sense rectal fulness, was not directly attacked. It may be that, in addition to direct contingencies for toilet defecation, careful physical examination together with procedures to bring the sensations into awareness as discriminative cues for voiding could produce more rapid learning.

Toileting as a complex skill

Many researchers have been concerned with the efficacy of operant procedures in teaching toileting skills when many or all of the component behaviours and discriminations required are lacking. Most of this work has been done with retarded children and adults using the theoretical analysis by Ellis (1963) as a basis. There have been a number of studies involving the retarded, but these studies do not provide enough information to analyse the procedures used. However, they generally demonstrate that considerable improvement in the toileting behaviour of retarded and autistic individuals can come from an enthusiastic approach based on operant principles (Baumeister & Klosowski, 1965; Bigelow & Griffiths, 1972; Colwell, 1969; DeMyer & Ferster, 1962; Gorton & Hollis, 1965; Miron, 1966).

An additional group of studies, again with insufficient information about the actual procedures, introduced experimental or statistical controls in order to evaluate the effectiveness of training programmes for the retarded in comparison with either no training or with other procedures

(Bensberg, Colwell & Cassel, 1965; Eyman, Silverstein & McLain, 1975; Eyman, Tarjan & Cassady, 1970; Gray & Kasteler, 1969; Kimbrell, Luckey, Barbuto & Love, 1967; Roos & Oliver, 1969). These add some validity to the claims made in the demonstration reports that training was the effective factor in increasing toileting skills. In addition, Leath and Flournoy (1970) provided further evidence of long-term maintenance of training effects over three years for the children in the study by Kimbrell et al. (1967). However, several programmes which also resulted in significant improvementwere not based on operant principles (Eyman et al. 1970, 1975). Moreover, few comparative studies have controlled for increased attention and stimulation, higher staff ratios, or heightened motivation among staff. Blackwood's finding (1962), that improvements in toileting were equally achieved in a less crowded setting with a higher staff ratio, suggests further that factors other than operant procedures may be involved.

Five studies with groups of institutionalized retarded children only rewarded voiding in the toilet, although many of the subjects were also unable to perform most of the other elements in the toileting chain (Dayan,1964; Hundziak, Maurer & Watson, 1971; Spencer, Temerlin & Trousdale, 1968; Watson 1968; Yoder, 1966). Reward was also provided by Spencer et al. (1968) for remaining seated on the toilet if, during baseline, subjects were incontinent more than 50 per cent of the time. Although there were general increases in toilet use, two papers reported no accompanying decrease in accidents (Hundziak et al. 1971; Watson, 1968). In the other three the children were toileted so frequently or for such long periods that it is doubtful whether the training staff did much more than increase their own ability to catch involuntary voiding (Dayan, 1964; Spencer et al. 1968; Yoder, 1966). The lack of detailed behavioural measures is one factor which makes it difficult lo assess whether this was so. Waye & Melnyr (1973) provided more convincing evidence of voluntary control in one blind profoundly retarded child, under similar training conditions, with the addition of a measure of time between first sitting on the toilet and voiding. At the beginning of training the child sat for seventy minutes before voiding. This reduced to seven minutes by the second week and to only a few seconds by the tenth week. At the same time accidents were also markedly reduced. Despite this additional quantitative data, however, it is still not possible to attribute the toileting improvements in these studies solely to the reinforcement contingencies. However, the experimental controls introduced by Hundziak et al. (1971) demonstrated that children increased their toilet use significantly more with reward than with a toileting schedule alone, although only one subject acquired additional elements in the toileting chain.

It does appear from these studies that reinforcing toilet voiding at least partly established the stimuli surrounding sitting on the toilet as elicitors for voiding. However, few subjects learned to completely inhibit voiding in other places, or carry out the rest of the toileting chain, and a number of subjects were not influenced by the reinforcement procedures at all. It is possible that the few subjects in the above studies who did begin to toilet themselves either already possessed many of the skills which were not directly reinforced or acquired some of the new non-reinforced skills incidentally. This was certainly the case in the studies of normal infants by Brown & Brown (1974), Madsen (1965) and Pumroy & Pumroy (1965). Pumroy and Pumroy studied their own normal 2-year-old children. Before training began, both children voided in the toilet when taken, although they still had accidents, and one occasionally asked to be toileted. They were not required to become fully self-sufficient. Nevertheless, it took over five months for successful toileting to be established so that accidents no longer occurred. Reinforcement was only for voiding in the toilet after asking to be toileted, although the children were also toileted at other times. However, to achieve the required bowel and bladder control, discriminations and responses which were not directly reinforced also had to be learned. These included recognizing bowel or bladder tension and inhibiting reflex voiding until correctly positioned on the toilet. In the absence of experimental controls, the cause of this gradual behaviour change is especially in doubt in the light of Muellner's suggestion (1960a,1960b) that the bladder and bowel control required of the Pumroy children is usually acquired by normal children at around 2 years of age as a self learned skill. The

19-month-old in Madsen's study (1965) only took twelve days, under apparently similar training conditions, to achieve similar proficiency. However, this success was reported by Madsen on the basis of parents' subjective reports with no supporting quantitative evidence.

Brown & Brown (1974) established behaviour control with their 17-month-old child much more rapidly than Pumroy & Pumroy (1965), and clearly demonstrated this control with a reversal condition, although no follow-up data were provided. Discrimination learning was made easier by toileting only when the child signalled. In addition, reward during the first phase of training was contingent on signalling itself as well as on voiding in the pot following the signal. During the sixteen days of training, the frequency of accidents was considerably reduced while signalling and voiding in the pot increased. This pattern was reversed when the reinforcement ceased and reinstated once reinforcement was again applied. However, false signals were also more frequent under reinforcement conditions. This may indicate that discrimination of bladder cues was not fully established. Direct discrimination training may have made it easier for the child to link signalling with the bladder cues.

Many recent studies have based their programmes on a more complex analysis of the toileting chain, together with specific procedures to strengthen the identified components. Although Whitney (1966) suggested backward chaining as the method of choice, no studies have actually reported the use of this procedure. One major deterrent is the nature of untrained voiding, which is essentially respondent rather than operant. Another is the predetermined nature of the eliciting stimuli from bladder and bowel distension. Chaining as a procedure has usually been demonstrated with behaviours and eliciting stimuli which are arbitrary to a large extent (Millenson, 1967), A third deterrent is the difficulty of both observing and directly modifying the internal sphincter responses. Consequently, those attempting a more complex analysis of toileting have looked for other methods of skill building.

Some researchers have identified only two or three toileting components for modification, with varying success. Besides rewarding toilet use, Ando (1977) punished accidents and later shifted rewards to self-initiated toilet use. Kartye (1971) added shaping for longer toilet sitting, and Connolly & McGoldrick (1976) added rewards for dry pants and a gradual stretching of the toileting schedule. Completely accidentfree self-toileting was not achieved in any of these studies. However, Connolly and McGoldrick reported a decrease in the number of voidings a day. This suggests that holding ability may have been increased by their procedures.

Barrett (1969) only rewarded toilet defecation. However, urination and defecation often occur together. It is therefore likely that toilet urinations came under an intermittent reinforcement schedule as well. In fact, the rate of toilet defecations did not change during five weeks of training although the rate of toilet urinations increased and urinary accidents ceased. An aversive condition was then introduced for bowel accidents which decreased to zero within two weeks. With the addition of suppositories to overcome faeces retention, toilet use was finally established 100 per cent of the time and the child began to toilet himself independently. Wolf, Risley, Johnston, Harris & Allen (1967) also established toileting in an autistic child by strengthening toilet urination and defecation separately, with reward becoming increasingly intermittent as each behaviour was firmly established. Cumulative records show clearly each behaviour coming successively under the control of positive reinforcement while at the same time accidents decreased to zero.

In 1966, Giles and Wolf reported the first of several highly complex toilet training programmes. The procedures were individually tailored to suit each of the in stitutionalized profoundly retarded children. Carefully monitored food deprivation allowed meals to be used as rewards, in addition to individually preferred activities and objects. Shaping procedures established toilet sitting, appropriate handling of clothes, and independent toilet approach. Toilet defecation was strengthened first, with aversive conditions for soiling to reduce accidents when necessary. The

aversive conditions functioned either to suppress soiling while toilet defecation was strengthened or to establish toileting behaviour as an avoidance response which could be further strengthened by positive reinforcement. Suppositories and milk of magnesia served to
increase response rates in some children and may also have heightened awareness of bowel distensions. Finally, bladder control was strengthened and the schedule of reinforcement thinned. Generalization to the ward was achieved by reintroducing continuous reinforcement until performance again reached the level achieved during training.

Although Giles and Wolf included no experimental controls or follow-up data they provided the first impressive demonstration that the full toileting chain could be reliably established in children who not only had none of the component skills but also showed little prior evidence of learning. Since this study a variety of complex procedural combinations has been reported (Azrin, Bugle & O'Brien, 1971; Azrin & Foxx, 1971; Hamilton, 1971; Fielding, 1972; Foxx & Azrin,1973a; Grabowski & Thompson, 1972; Levine & Elliott, 1970; Mahoney, Van Wagenen & Meyerson, 1971; Passman, 1975; Tierney, 1973; Van Wagenen, Meyerson, Kerr & Mahoney, 1969). Five of these studies used a reversal or control group design, but the comparisons were only made with no-training conditions so that attention factors cannot be ruled out (Azrin et al. 1971; Azrin & Foxx, 1971; Passman, 1975; Tierney, 1973). Two studies in particular have resulted in further studies which have introduced procedural refinements and evaluations (Azrin et al. 1971; Van Wagenen et al. 1969).

Azrin and his colleagues refined their initial programme for the severely and profoundly retarded (Azrin & Foxx, 1971; Foxx & Azrin, 1973b). The procedures involved strengthening toilet approach, handling clothing, sitting, toilet voiding, flushing the toilet, and remaining dry. Responses were elicited by prompts and graduated manual guidance rather than a strict shaping procedure, and these were gradually faded while rewards were made increasingly intermittent as behaviour was established. Incompatible stimuli and behaviour were reduced to a minimum and increased fluid intake with toileting every half-hour ensured frequent practice. Accidents were punished with reprimands, an overcorrection procedure, and time-out from reinforcement. Pants- and toilet-alarms ensured immediate delivery of consequences. After the first selfinitiated toileting occurred, toileting by the trainer ceased, reinforcement was transferred to self-initiated toilet use, and reinforcement schedules were thinned. Trainees moved back into their usual environment once they were selfinitiating most of the time. A less intensive programme of rewards for remaining dry and punishment for accidents was continued until there were no accidents for several weeks.

Modifications of this programme for normal toddlers included instructions to carry out the training procedures with a wetting doll, more verbal instructions during training, less arduous punishment procedures, more emphasis on social reward, more frequent trials, and only a few days of maintenance after training (Foxx & Azrin,1973a; Azrin & Foxx,1974). Time taken to learn self-toileting by nine retarded trainees was one to fourteen days, and accidents after training reduced to zero within one-and-a-half to five months (Azrin & Foxx,1971). Normal toddlers took half-an-hour to fourteen hours to become self-toileting and maintained accident-free performance during a four month follow-up period (Foxx & Azrin, 1973a).

The procedures for the retarded were replicated by Bettison, Davison, Taylor & Fox (1976), who found that not all trainees achieved full independence. In addition, some of those who did become independent were again having accidents eight to eleven months after training.

A number of other studies have further modifed the procedures. Besides supporting some of the findings of Bettison et al. (1976), they suggest that the over correction procedure may make no difference to acquisition (Singh, 1976), and is either emotionally disruptive or actually enjoyable for some trainees (Smith, 1978). In addition, training often took considerably longer than originally

reported (Dixon & Smith, 1976; Smith, Britton, Johnson & Thomas, 1975; Smith & Smith, 1977). More gradual progress through training and maintenance than was the case in the original programme may also be necessary (Singh, 1976; Smith et al. 1975), especially for children with other handicaps (Butler, 1976a). The procedures for normal children have been repeated by parents as reported by Butler (1976b), Matson (1975) and Matson & Ollendick (1977). They also found that the over-correction procedure for some children was emotionally disruptive.

Sadler & Merkert (1977) have provided the only published experimental evidence that the Foxx and Azrin method is more successful than the traditional methods of toilet scheduling. Wetting was the only measure reported. The frequency of accidents was reduced by the end of the training period in both conditions as well as in a no-training condition, but the reduction was significantly greater with the Foxx and Azrin method.

The original procedures used with nine profoundly retarded children described by Van Wagenen et al. (1969) were extended further and also demonstrated with normal toddlers (Mahoney, 1973; Mahoney et al. 1971). In addition, Mahoney (1973) provided the most comprehensive set of toileting measures to be found in the literature. They directly strengthened inhibition of reflex voiding, toilet approach, handling clothing, sitting or standing at the toilet, and toilet voiding, but not flushing the toilet or remaining dry. No aversive consequences were contingent on accidents. Each element was added to the chain in order, starting with toilet approach. The required behaviour was elicited by verbal prompts and physical guidance, which were faded as the behaviour became established. An additional elicitor for toilet approach was a tone from a pants-alarm worn by the child and activated by the trainer. Reward followed immediately on the last element of the chain which was being strengthened. Once the tone reliably elicited voluntary approach, pants lowering, and correct positioning at the toilet, fluid intake was increased. After the first toilet use, reward was shifted to follow voiding. Onset of voiding in the pants also activated the pants-alarm. When this occurred and the child did not immediately go to the toilet, the trainer said 'No!' Go potty!'. This was intended to inhibit reflex voiding so that the child could be quickly taken through the toileting chain and continue voiding in the toilet. Once pants return was added and the toileting sequence was consistently performed in response to the urineactivated tone, the trainer again generated the tone whenever the child showed signs of impending voiding. Eventually the pants-alarm was removed and reward was made contingent on unprompted independent toileting.

Time taken to achieve independent toileting by both the normal and retarded children was fourteen to eighteen hours. Although no quantitative follow-up data were provided, the authors indicated that some children were wetting occasionally after training, but that this was usually accompanied by the reintroduction of toileting prompts by the parent. Nevertheless, all the children toileted themselves and accidents were greatly reduced.

Litrownik (1974) simplified the Van Wagenen procedures for an all-day programme carried out by the parents of a profoundly retarded 7-year-old. The pantsalarm used was not able to be remotely activated but still sounded when voiding occurred. Consequently, some of the steps in the original programme were not possible. Progress through the programme was gradual, so that periods of overlearning occurred. Training to independence took seven weeks and performance was maintained with no relapses for five months after training.

Three studies have attempted to tease out the specific effects of some of the individual procedures in the Azrin and Foxx and Van Wagenen programmes. Madsen, Hoffman, Thomas, Koropsak & Madsen (1969) reported the results for seventy normal children between 1 and 3 years of age. One group of children were toileted at predetermined times. A shaping procedure was used to teach them to sit on the pot, and they were rewarded for doing so. A second group wore pants-alarms, without remote activation, and were taken to the pot whenever the alarm sounded.

No rewards or shaping were involved. A third group received both of these procedures. The three groups were compared with a further two groups who either received no training or training devised by the parents. Measures were taken of both frequency of voiding in the pot and frequency of accidents. The three special procedures were equally successful in reducing accidents compared with the two control groups. However, reinforcement, with or without the pants-alarm, was the most effective in increasing voiding in the pot. The youngest children (12-14 months-old) had least success.

The more complex programmes differ in a number of important aspects: methods for training discrimination of bladder and bowel distension, methods for inducing inhibition of reflex voiding, the order of establishing component skills, and the methods of training the non-voiding skills. Smith (1978) and Wright (1975) both isolated two of these aspects for evaluation.

In Smith's (1978) study two groups of five institutionalized severely and profoundly retarded children received different procedures. The first incorporated a modified Azrin and Foxx system of aversive consequences for accidents together with pants-alarm. The second incorporated modified Van Wagenen procedures using the remotely activated pants-alarm as an additional prompt for toileting and the startle technique when the alarm was triggered by voiding, followed by immediate toileting. Both these procedures are directed at establishing discrimination of impending voiding and inhibition of non-toilet voiding. Although some other aspects of the programmes were not exactly the same for the two groups, in most respects the training schedule was standardized using the Azrin and Foxx methods, with increased fluids, toilet alarms, half-hourly trials, reward for toilet use, and all other components strengthened at each trial using the faded prompts, guidance, and reward procedures. A third group received the modified Azrin and Foxx procedures in a group training programme. Accidents reduced in both groups by about the same amount, and all but one child achieved independence. The unsuccessful child was highly resistant to training in general. Only one child achieved independence with group training, although all improved in toilet voiding and accident rate by the end of training. However, the group programme was considerably less rigorous, so this finding may only reflect the effects of programme complexity.

Wright's (1975) comparative study took place under more standardized conditions. All children in the experimental groups received extra fluids and rewards for toilet use. A further two groups of four children were assessed under similar staffing conditions, and either received extra stimulation or the usual ward routine. Four procedures were combined using a two-factor design and were as follows: faded prompting, guidance, and reward for the non-voiding skills (Van Wagenen et al. 1969); urine activated pants-alarms with the startle technique followed by immediate toileting (Van Wegenen et al. 1969); physical help with no fading or reward for the non-voiding skills; a toileting schedule with no pants-alarm based on the usual voiding times as advocated by Ellis (1963). Measures were taken during baseline, during the first and last five days of training, and six months after training. Urination and defecation were recorded separately for toilet use, self-initiated toilet use, and accidents. Performance of all other components in the chain was assessed on a 5-point scale to give an overall measure of degree of independence. In general, all four experimental groups improved on all measures, while the control groups remained at the pretest level. Only the prompting procedure clearly had a specific effect. Progress to full independence was significantly better under this condition. This was probably because it directly trained behaviours such as toilet approach and clothing management which allowed the children to cease relying on staff for help.

Both these studies suggest that, within a highly structured toilet training programme which provides each child with individual attention and frequent rewards for a number of the components, varying some individual procedures makes little difference. This was so even when a number of highly specific measures were examined (Wright, 1975). However, it does appear that some form of specific shaping for the non-voiding components is required for full independence.

Conclusion

Behaviour modifiers who look to the literature for toilet training techniques to offer to their own clients have a range of procedures from which to choose. However, many studies do not describe the level and range of toileting skills possessed by their trainees before training, although this review suggests that these are crucial variables in determining the most effective and economic techniques. In addition, few researchers have provided evidence which rules out increased attention, positive expectations of parents and training staff, and a systematic approach *per se* as the operative factors in successful toilet training. This is of both theoretical and practical importance to the management of complex human skills acquisition. Furthermore, there have been few attempts to account for organismic factors involved in bladder and bowel control. A close analysis of those who fail or only partially succeed during training programmes may throw some light on this issue as it has done in recent research into learning amongst developing or damaged animals (Teitelbaum, 1977).

Nevertheless, the usefulness of operant procedures in teaching the component skills in toileting cannot be disputed. The systematic nature of procedures required by the operant approach has enabled parents, teachers, and institution staff to carry out the training reported in many of the papers reviewed here. The general impression is that the provision of consequences contingent on one or two behaviours has led to fully independent toileting only when all or most of the other elements and links in the chain have already been fully established. Some children could incorporate several new elements into the chain when only one was directly trained. However, acquisition appeared to take longer under these conditions and was less likely to occur in the severely and profoundly retarded. The more complex procedures, in comparison, have led to much faster reductions in accidents, with fewer accidents and a greater likelihood of independent toileting at the end of training. This was so for both the retarded and for normal children, although generally the more retarded an individual, the longer acquisition has taken (Smith & Smith, 1977).

The success of the more complex procedures has led to several training manuals which describe toilet training procedures (Azrin & Foxx, 1974; Baldwin, Fredericks & Brodsky, 1973; Foxx & Azrin, 1973b; Larsen & Bricker, 1968; Watson, 1973). However, there is some doubt about the value of such manuals without additional training and support from skilled professionals (Butler, 1976b; Kimmel, 1974; Matson, 1975; Matson & Ollendick, 1977). There are also a number of devices described in the literature designed to aid trainers in the immediate delivery of consequences during toilet training. These include pantsand toilet- or potty-alarms (Azrin et al. 1971; Cheney, 1973; Corey & Dorry, 1972; Dixon & Smith, 1976; Fried, 1974; Glen & Rowan, 1974; Herreshoff, 1973; Kashinsky, 1974; Logan & Garner, 1971; Smith, 1977; Van Wagenen & Murdock, 1966; Yonovitz, 1976), automatic reward dispensers (Cheney, 1973; Hundziak et al. 1971; Marshall, 1966; Passman, 1975; Watson, 1968), and a buzzer system to signal selfinitiated entry into the toilet (Hamilton, 1971).

A number of practical problems have been noted. At least two authors have reported failure to achieve independence by some trainees even with the use of complex procedures, skilled trainers, and relatively controlled conditions (Bettison et al. 1976; Smith, 1978). In addition, there are some indications that the component behaviours and discriminations involved in toileting respond differently to currently available training programmes and may need to be examined separately (Hamilton, 1971; Hundziak et al. 1971; Madsen et al.1969; Wright,1975). Transfer of toileting skills to the natural environment has also proved a problem in some studies which include follow-up data. A return to prompting by parents or staff, the absence of naturally occurring reinforcers, and the failure of training to link toileting to bladder and bowel tension, have all been suggested as possible reasons (Baumeister & Klosowski, 1965; Mahoney et al. 1971; Osarchuk, 1973; Van Wagenen et al. 1969; Watson, 1967). How to turn parents and staff into effective

behaviour modifiers has also been an issue of concern for some time (Bettison & Garlington,1975; Clark, Evans & Hamerlynck,1972; Watson, 1973). However, this problem has received little attention in relation to toilet training.

Many of these problems will not be solved until we can objectively determine which are the most effective procedures for toilet training or even that operant procedures are any more effective than other equally intensive training programmes. The general inadequacy of research design and the lack of comparability among studies certainly makes this difficult (Gardner, 1969; Watson, 1967). However, this review suggests that a basic difficulty lies in the variety of behavioural deficits which can contribute to incontinence. Adequate and direct measures of the many internal and external responses and discriminations involved in toileting are needed before controlled evaluation of the specific effects of training procedures is possible.

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