A COMPARISON OF TOILET TRAINING STRATEGIES FOR THE RETARDED

by

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A COMPARISON OF TOILET TRAINING STRATEGIES FOR THE RETARDED

SUMMARY

Problems with bladder and bowel control, and failure to develop self control of toileting at an early age can cause considerable distress. Among such cases only a minority involve obvious organic pathology. Instead, difficulties appear more often to lie in learning toileting control. Solutions to these problems are not only of practical value, but have considerable theoretical interest for the student of complex human skill learning. The study of self-toileting among retarded people is of particular value because many do not learn incidentally and require direct teaching of most components of toileting. During the teaching of skill components, the learning process and the factors which affect them can be observed and studied in a way which is not possible when learning is spontaneous. Considerable research has centred around night time bladder control, but little systematic research has been concerned with the total self-toileting process.

This series of studies was therefore concerned with the learning of self-toileting by retarded people, and the training procedures which may facilitate it. A review of the available information on the rate of failed bladder and bowel control among retarded people as compared with non-retarded people established that the problem was extensive, especially among young, severely and profoundly retarded persons and those who are in institutions. A survey of the population in the State institution for the retarded (Strathmont Centre) confirmed this. It showed that in 1974, 54.6 percent were incontinent to some extent, with most cases showing no apparent underlying organic pathology, thus providing support for the view that

incontinence in the majority of retarded persons is primarily a learning problem and therefore amenable to training. The high rate of incontinence among the younger more retarded persons in the institution led to an investigation of toilet-training strategies aimed at these two groups.

A review of toilet training studies with both retarded persons and non-retarded children suggested that, unless most of the component skills involved in self-toileting have already been learned, simple training procedures which treat toileting as a single unit of behaviour are unlikely to lead to self-toileting. Several programmes to teach the components of self-toileting have been reported, the most well documented being that designed by Azrin and Foxx. This programme was therefore selected as the basis for a study of both the acquisition of the self-toileting sequence and some of the learning principles and procedures which have been used to facilitate it.

The first project was a six month trial of the Azrin and Foxx programme with eight retarded, institutionalized persons, together with an assessment of its long term effects. All but three trainees mastered self-toileting within the maximum time suggested by Azrin and Foxx, the accident rate was reduced during training for all but two trainees and four completed the maintenance programme successfully within the allotted six months. Differential effectiveness with different types of cases was also indicated. Assessment eight to eleven months later showed that five of the seven trainees had maintained their reduced accident rate, but that only one was still self-toileting all the time.

This trial did not achieve the level of success that Azrin and Foxx had reported, and it raised several methodological questions, including the adequacy of accident rate as a measure of toileting performance. Nevertheless, the programme incorporated a number of training principles which are commonly used in many toilet training programmes. Therefore, the second project was an eighteen month study which attempted to assess the effects of three of the major of these principles within the Azrin and Foxx programme, viz. (i) the provision of consequences contingent on voiding, (ii) procedures to elicit and shape the socially required toileting tasks, and (iii) the use of alarm signals at the onset of voiding. The study used a three-way factorial design with two levels on each factor. The first level of a factor consisted of a set of procedures based on one of the three training principles, and the second was a control condition. The three control conditions consisted of: (i) non-contingent consequences for voiding, (ii) no systematic procedures to shape the associated toileting tasks, and (iii) alarm signals which were not related to the onset of voiding. Thirty two children were divided into eight groups of four so that each group received a different combination of training and control procedures. The main measure was the toileting scale of the Balthazar Adaptive Behaviour Scales, which provides a standardized score based on ratings of a number of toileting components rather than only one component such as accident rate.

There was general improvement in day time toileting after training irrespective of training condition. This improvement was maintained six to eighteen months later. Night time toileting was not a target of training and did not improve. Despite the evidence of success, even for control conditions, with regard to day time toileting, less than half the children mastered self-toileting during training. Analysis of the training records indicated that many children did not master certain of the component skills, and only some components were affected by the training conditions. It was suggested that the Azrin and Foxx programme did not teach some essential toileting skills, did not bring all components under stimulus control and did not ensure that each skill was firmly incorporated into the self-toileting sequence. These inadequacies in the application of learning principles may have obscured their effects on acquisition.

The third project was a twelve month study which addressed these problems. The self-toileting sequence was analysed into its components and a new training programme was designed which involved backward chaining of the sequence, the provision of additional discriminative stimuli for each component skill, clear criteria for success in the performance of each skill, and ten measures of the component skills before and at the end of training.

As well as testing the efficacy of the new programme, the third project investigated further the effects of environmental consequences and their response contingencies, as these are central concepts in many learning theories and their application to skills acquisition. The new programme was used with eighteen retarded children from home or institutional backgrounds to assess its effects under three conditions relating to response contingencies. All children received training, but one group of six received contingent consequences, one received non-contingent consequences and one received no systematic consequences.

All children achieved mastery of three skills and most mastered the majority of the remaining skills within the allotted time. There was no clear effect of either reinforcement or contingency on the acquisition of any of the component skills. Improvement in toileting at follow-up was generally significant, although children who lived at home maintained some of their new toileting skills better than institution children. Although direct comparison of the new programme with the Azrin and Foxx programme was difficult there was some evidence that the former was more successful.

In the light of these studies it was suggested that the acquisition of toileting skills by the retarded appeared to depend on the arrangement and breakdown of component tasks, frequent practice in a structured environment and the immediate feedback provided by success. If self-toileting is typical of complex human skills generally, then the systematic application of reinforcement principles which has proved so effective in the modification of simple responses may be largely irrelevant in relation to the acquisition of complex sequences of responses. However, once a complex skill has been assembled, its performance as a unit may then respond to environmental consequences in much the same way as any other unitary response. The areas requiring further research involve procedures which will bring bladder and bowel functions under increased voluntary control and enhance generalization to real life situations.

STATEMENT

This thesis contains no material which has been accepted for the award of any other degree or diploma in any University, and to the best of my knowledge contains no material previously published or written by another person, except where due reference is made in this text.

Signed

Suzanne Bettison

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PREFACE

The series of studies reported in this Thesis was part of a larger service project, undertaken by the author, whose aim was to establish a range of independence training programmes and behaviour change procedures throughout the State-run services for the retarded. As such, the studies were applied in nature, with the major aim being to develop a set of effective toilet training procedures which could be offered to retarded persons. The approach adopted was based on principles derived from the empirical study of operant conditioning and the application of these to a variety of human problems.

It was only within the context of this larger project that a long-term study of toilet training became possible, since the project created acceptance of behavioural research among both staff and management, organizational support for such research, and a body of competent trainers who were eager to be involved in programmes which they believed would benefit their clients. This service-oriented context had a considerable influence on the course which the research took. For this reason it is useful to briefly outline the major aspects of the service project.

The first stage of the project was designed to show administrators and staff that applied behaviour analysis could be used by direct care staff to benefit their clients. It began in the South Australian State institution with a demonstration intensive training programme for eight severely and profoundly retarded children who had proved unresponsive to standard child rearing methods. It ran for twelve months and provided locomotor and sensory-motor skills training as well as the modification of a range of behaviour problems. At the same time, a seminar series on behaviour modification with the retarded was mounted in conjunction with the Flinders University of South Australia. Staff from most of the major health, education and welfare agencies servicing retarded clients attended. Institution staff who attended were helped to carry out a number of individual behaviour change studies which were used as practical demonstrations during these seminars.

The results from these two ventures led to the second three-year stage of the project which concentrated on staff training and programme development. Behaviour modification modules were included in the normal training programmes for institution staff. In addition, the intensive training programme was expanded to service an additional eight children. This programme was provided with its own staff in order to develop and test procedures for promoting self helf skills and supervise the training of institution staff in their use.

During the first year of this programme, all residents were assessed to determine which skill deficiencies were causing most problems for both residents and staff. The survey of incontinence reported in Chapter 2 was part of this assessment, and indicated that lack of bladder and bowel control created more problems for residents, staff and administrators than any other skill deficit. As a result a temporary unit was set up, with its own staff, to do toilet training research. This unit ran trials of the Azrin and Foxx toilet training programme during the first half of the subsequent year, followed by an eighteen month study of the three major training strategies used in that programme. These are reported in Chapters 5 and 6.

Up to this point training programmes were developed with the one group of children and there had been no opportunity to test them with a wider range of clients. The toilet training unit was the first to offer a particular skill training programme to clients from anywhere in the institution, according to need. It demonstrated that not only was this administratively possible, but was also an effective way of incorporating behavioural training into the ongoing services provided by the institution.

By the end of this stage in the project, requests were coming from both the community and staff in the institution for help with a wide range of behaviour problems and skill deficits. The third stage of the project therefore involved the establishment of a permanent Intensive Training Unit in the institution to which both community and institution children could be referred, and a Family Training Unit in the community for clients who needed less intensive programmes. The Intensive Training Unit continued to develop new programmes and train institution staff. The Family Training Unit provided training workshops for parents and field workers throughout the State, helped set up behaviour modification projects in other agencies, and began an early intervention service for infants at risk of retardation.

The initial work with the Azrin and Foxx toilet training programme revealed a number of procedural inadequacies which reduced its effectiveness for some clients. Therefore, a new toilet training programme based on chaining principles was designed and used in a further study of training strategies in toilet training. This study was carried out in the Intensive Training Unit during its second and third year of operation, and is reported in Chapter 7. The new programme was incorporated into the range of services offered by the Unit, a development which has since helped the author to introduce the programme into three residential facilities in other States.

As can be seen from this outline, the toilet training research reported here has been an integral part of service development. However, the need for effective toilet training procedures was not the only reason for the research. A further motivation came from a growing interest in the factors which control the acquisition of complex human behaviour in general. Most of the service project's work was concerned with complex skills such as walking, dressing or language. The functional analysis and environmental arrangements required to induce these skills were very different from those involved in the modification of simple behavioural units such as eye contact, in-seat behaviour, head banging or temper tantrums, even though operant principles were applied in both cases. This interest influenced both experimental design and the interpretation of results. Furthermore, it is this aspect of the research which informs the suggestions for future research which are discussed in the final chapter.

Some of the material in this Thesis has been published elsewhere. The majority of Chapter 3 appeared as a book chapter. The pilot study described in Chapter 5 was reported in a paper written in collaboration with the training staff, who contributed the methodological content, tables and figures under my direction. A manual for the chaining programme, described in Chapters 7 and 8, and included in full in Appendix 9 , has been published in book form. In addition, three other publications resulted indirectly from the work reported here. The paper written in collaboration with W. Garlington described the results of the first staff training seminars. These determined the nature of staff training during the toilet training research. The second was a paper discussing the aspects of bladder and bowel control which need to be taken into account in the design of toilet training programmes for retarded persons. The third was a chapter on toilet training in a book on children's problems. These publications are listed below in the order in which they appeared.

Bettison, S., & Garlington, W. Behaviour modification with the mentally retarded : A staff training programme. Australian Journal of Mental Retardation, 1975, 3, 131-145.

Bettison, S., Davison, D., Taylor, D., & Fox, B. The long-term effects of a toilet training programme for the retarded : A pilot study. Australian Journal of Mental Retardation, 1976, 4, 28-35.

Bettison, S. Toilet training the retarded : Analysis of the stages of development and procedures for designing programmes. Australian Journal of Mental Retardation, 1978, 5, 95-100.

Bettison, S. Toilet training. In M.W. Griffin & A.M. Hudson (Eds.), Children's Problems. Melbourne: Circus Books, 1979.

Bettison, S. Daytime wetting and soiling. In A.M. Hudson & M.W. Griffin (Eds.), Behaviour Analysis and the Problems of Childhood. Collingwood, Victoria: Pit Publishing, 1980.

Bettison, S. Toilet Training to Independence for the Handicapped. A Manual for Trainers. Springfield, Illinois: Thomas, 1982.

CHAPTER 1.

THE PROBLEM OF INCONTINENCE AND ITS PREVALENCE

1.1. INTRODUCTION

Voluntary control of bladder and bowel functions is acquired by most people in our society by about four years of age (Lovibond & Coote, 1970). After this age failure to organize voiding so that it occurs only at acceptable times and in acceptable places is regarded as a problem. The term "incontinence" is commonly used in the literature to refer to this failure. Other terms are also used. Incontinence of urine alone is often called enuresis, or nocturnal enuresis if it occurs only at night, while encopresis refers to incontinence of faeces.

However incontinence is described, it is one of the most common behavioural deficits found in the general community (Ross, 1971). Although it is a problem which has been recognized for centuries (see 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). An examination of the literature on incontinence and toilet training provides some idea of the extent of the problem. 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, 1969; Werry, 1973; Wright, 1973). In addition, incontinence is a major reason for the institutionalization of clients, especially among the retarded and the aged (Caldwell, 1975; Bayley, 1973; McCoull, 1971; Shuttleworth, 1970; Smith, Britton, Johnson & Thomas, 1975).

The series of studies reported in this Thesis is concerned primarily with incontinence among the mentally retarded. However, the discussion in this chapter also refers to incontinence among those who are not retarded in order to put the situation for the retarded into the context of the population as a whole.

1.2. DEFINITION OF INCONTINENCE

Incontinence is conventionally defined as the repeated involuntary discharge of urine or faeces. However, everyone is born incontinent by this definition. The available evidence suggests that 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 occasional failures during acquisition. There are large individual differences in the time taken to achieve final control, as born out by studies of the incidence of incontinence among young children of different ages (Yates, 1970). Hald (1975) further makes the point that many people experience some involuntary discharge of urine from time to time, but that this only poses a problem if it is frequent, unmanageable, or in quantity, and is regarded as socially or hygienically unacceptable. What is socially and hygienically unacceptable varies according to the values of the individual, the culture, and the sub-cultural group in which he or she lives. Hald (1975) also suggests that the extent of the problem depends in part on the therapeutic resources in the community. If a condition is seen to be remediable, and therapeutic services are available, definitions of what constitutes an incontinence problem will be refined accordingly.

Two further factors need to be considered when defining incontinence. There are some clinical conditions involving the involuntary discharge of waste through passages other than the bladder or bowel. Hald cites discharge through fistulae from the upper urinary tract as one such condition which would not be regarded as incontinence. Incontinence has also been reported as a purposeful act. Some cases have been described of children, retarded people, and psychiatric patients, who have resisted toilet training and intentionally voided anywhere but in the toilet (Anthony, 1957; Coekin & Gairdner, 1960; Schaefer & Martin, 1969; Wiesen & Watson, 1967; Wright, 1973). All these factors should be acknowledged when considering incontinence as a behavioural deficit requiring treatment or training. The definition used for the purpose of this thesis is as follows:

> Incontinence is the repeated discharge of urine or faeces from the lower urinary tract or bowel in places which are socially unacceptable, after the age at which bladder and bowel control is ordinarily attained by the majority, to a degree that imposes a socially or hygienically unacceptable situation upon the individual and/or others.

A number of authors have discussed the importance of distinguishing sub-categories of incontinence in terms of aetiology and prognostic significance (Anthony, 1957; Coekin & Gairdner, 1960; Hald, 1975; Lovibond & Coote, 1970; Vincent, 1964, 1966; Werry, 1973; Yates, 1970). Distinctions of this kind are generally made in relation to pathological conditions or nocturnal enuresis. The focus of this Thesis is primarily day time incontinence where no apparent organic pathology is involved.

1.3. THE EFFECTS OF INCONTINENCE

Many authors have been concerned with the effects of incontinence on daily life and well being (Caldwell, 1975; Hald, 1975; Shuttleworth, 1970; Willington, 1975; Woodmansey, 1967). Young children and their parents come under great social and family pressures if the children do not learn bladder and bowel control at about the same age as most other children. For older children and adults incontinence can be a personal and social disaster which leads to misery and the curtailment of recreation and work. Many of those with severe incontinence are unable to work at all and receive public assistance (Hald, 1975). It can force a person into the life of a social recluse, and, if the sufferer also needs supervision and care, it can curtail the freedom of the rest of the family. The laundry requirements alone can become difficult to handle, so that permanent residential care within an institution is a frequent result with its additional restrictions.

Sufferers who are also physically handicapped, bedridden, or who lack the ability to care for themselves because they are severely retarded, can have continual problems with skin eruptions, small erosions or decubital ulcers (Kocsard, 1965). In addition, long-standing severe urinary incontinence may lead to organic shrinking of the bladder, especially in older adults, so that it may become impossible to effect any increase in bladder capacity without surgical intervention (Hald, 1975).

The retarded suffer additional social handicaps as a result of incontinence. Schools, workshops and recreational facilities such as swimming pools and theatres, are often unwilling to admit incontinent people for reasons of hygiene, or because they have no resources for handling incontinence. Considerable time and energy is expended by parents and institution staff in cleaning up faeces and urine and toileting the incontinent. This is one of the most unpleasant aspects of caring for the retarded. Despite their best intentions, many people find themselves withdrawing from close personal contact because of this unpleasantness. Not only does this deny incontinent retarded persons the learning which results from social contact, but the time given to managing the incontinence is then not available for stimulation, training and education. Incontinence thus overlays the backwardness of the retarded with reduced opportunities for learning.

In institutions for the retarded, incontinence is a health hazard for both residents and staff (Dayan, 1964; Foxx & Azrin, 1973b; Hollis & Gorton, 1967), and it is frequently associated with maladaptive behaviour such as faeces eating and smearing. Outbreaks of shigella and other diseases of the gastro-intestinal tract are common, although these can be controlled to some extent when the living units are designed for easy cleaning, resident groupings are small, and the staff-resident ratio is high. A factor which is often overlooked is the increased organization and expense involved in administering institutions which house the incontinent. Nursing and medical procedures are required to prevent the spread of infection, and extra drugs, linen, clothing and housekeeping need to be provided. For all these reasons, research concerning the amelioration of incontinence is of importance, especially if oriented towards immediate practical solutions.

1.4. PREVALENCE

Few attempts have been made to assess the prevalence of incontinence in the general population. Hald (1975) has provided a very rough estimate of the incidence of urinary incontinence, based mainly on Danish population data. He used known prevalence rates of incontinence associated with specific diseases and conditions, prevalence rates among the elderly, together with data on the rate of enuresis among children between 4 and 12 years of age, arriving at an estimate that 2% of the total population suffer from incontinence. No attempt has been made to assess the extent of faecal incontinence in the general population. It is frequently associated with urinary incontinence, but is generally regarded as less common (Werry, 1973).

Incontinence is not spread evenly across the population but mainly occurs in four distinct groups: children, the mentally retarded, the elderly, and people with clearly diagnosed diseases or conditions which are associated with problems of bowel and bladder control. The former two groups are of particular interest because of the apparent absence of demonstrable organic pathology in the majority of cases, and the consequent implications for a non-medical approach to amelioration. The following discussion of prevalence will therefore concentrate on these two groups, since it is this type of incontinence which is the primary concern of this Thesis.

A few surveys of incontinence among these two groups have been published. However, prevalence figures from these studies are based on widely differing definitions of incontinence. The criteria used range from completely uncontrolled voiding all the time to wetting the bed at least once in six months. Some studies have included a wide range of criteria for identifying those individuals who are incontinent, but have presented overall prevalence figures without indicating the contribution of each criterion group. In addition, not all authors define their criteria, often providing only vague descriptive labels such as "severely incontinent" or "nocturnal enuresis" (Kaffman, 1972; Smith et al., 1975; Yates, 1970). The reliability and representativeness of data are also open to question in some studies. Few studies involve the observation of the incidence of incontinence among their sample. Many have relied on the retrospective reports of parents, which are demonstrably unreliable (Wenar, 1961; Wenar & Coulter, 1962). Others have used responses to questionnaires, case note entries, or staff reports. In no studies has the reliability of these sources of data been assessed. Furthermore, many of the samples surveyed are unrepresentative, and cannot be seen as reflecting the situation which exists among the general population. This is especially true of studies based on clinical samples. Other studies, especially of children, only refer to selected and limited age groups (Kaffman, 1972; Yates, 1970).

The absence of uniform research methods and behavioural definitions, together with the dissimilar nature of sample characteristics, make a comparison of results from the different studies very difficult. These problems need to be borne in mind when examining studies of the prevalence of incontinence. The following review does not include those based only on clinical samples, although their results add supportive evidence to the proposition that incontinence is a major problem for which the health professions are frequently asked to provide solutions.

1.4.1. Incontinence among otherwise normal children

When considering incontinence as a problem among children, the age at which bladder and bowel control is generally achieved must be taken into account. Normally there is a consistent order of acquisition (Bellman, 1966; MacFarlane, Allen & Honzik, 1954; McGraw, 1940; Oppel, Harper & Rider, 1968; Stein & Susser, 1967). Bowel control at night is achieved first, followed by bowel control during the day. This is followed by the achievement of bladder control during the day, and finally, bladder control during the night is acquired. The sequence for bladder control is confirmed by Muellner (1960a, 1960b). Several authors have commented on the influence of social expectations and child-rearing methods on this sequence. Stein and Susser (1967) found some individual deviations from the sequence, and American data demonstrate that the day/night sequence of bladder control can appear in reverse order (Roberts & Schoelkopf, 1951). The age at which bladder control is achieved also appears to be influenced by social factors. For example, Kaffman (1972) found that kibbutz children in Israel tended to become continent at a later age than children in America, Europe or urban Israel. Consequently, although the sequence of acquiring bladder and bowel control and the age at which it is acquired can be seen as an expression of the maturation of organs and of the nervous system, it is also clear that variations in that sequence can occur as a result of external factors superimposed upon this maturation process.

Most studies of the prevalence of incontinence in children have derived their data from one sample of children within a specified age range. Some have selected one age group and obtained information from their parents about past and present incontinence rates (Bellman, 1966; Hallgren, 1956, 1957), although one such study only asked about the current performance of their sample (Roberts & Schoellkopf, 1951). Others have selected samples of children of different ages and collected data about their present behaviour from parents so that age trends could be examined (Bransby, Blomfield & Douglas, 1955; Blomfield & Douglas, 1956; Kaffman, 1961, 1972; Lapouse & Monk, 1958, 1964; Lapouse, Monk & Street, 1964; Oppel, Harper & Rider, 1968). Stein and Susser (1967) also looked at age differences, but derived these from recorded observations rather than from parent reports. MacFarlane, Allen and Honzik (1954) did the only longitudinal study which followed children over a period of years. These studies together provide data about the prevalence of incontinence among a wide range of children in several countries.

Only five studies were found which looked at day and night wetting and soiling (Hallgren, 1956; Lapouse & Monk, 1964; MacFarlane et al., 1954; Roberts & Schoellkopf, 1951; Stein & Susser, 1967). No studies could be found which gave figures on the prevalence of all forms of incontinence together. Most studies were interested in only one of these types of incontinence. This review will also look at each type separately and then draw some general conclusions about the development of bladder and bowel control among normal children in order to highlight the very different findings for retarded persons.

The average age by which the vast majority of children achieve continence appears to vary according to the type of control which is being considered. For instance, the only study which looked at night time bowel control found that most children had stopped soiling during their sleep by two and a half years of age (Stein & Susser, 1967). They also found that bowel control during the day was generally acquired by three years of age. This latter finding confirmed the earlier conclusions of Bellman (1966) and MacFarlane et al. (1954). Nearly all children appeared to achieve complete bladder control during the day by three and a half to four years and during the night by four to four and a half years (Bellman, 1966; MacFarlane et al., 1954; Oppel et al., 1968; Stein & Susser, 1967). In addition, girls tended to acquire these controls slightly earlier than boys (Bellman, 1966; Blomfield & Douglas, 1956; MacFarlane et al., 1954; Oppel et al., 1968; Stein & Susser, 1967). Generally, incontinence is not considered a problem until after four years of age, and requests for treatment or training are often not made until after children start attending school. Consequently, most prevalence studies have been concerned with school age children.

Most studies of incontinence in children have been primarily interested in nocturnal enuresis, since it is a more common problem than either soiling or day time wetting. A number of authors have summarized these studies (Jones, 1960; Oppel, Harper & Rider, 1968; Werry, 1973; Yates, 1970), and have noted the wide variation in frequency figures. It is extremely difficult to reconcile these figures because of the differing definitions and samples which researchers have used, as well as the different methods of obtaining the information on which the figures have been based. If we look only at those studies of large representative samples, the problems become clear. For instance, estimates of prevalence among four year olds have ranged from 7.9 percent (Hallgren, 1956) to 34 percent (Hawkins, 1962). Some of this difference may be due to cultural differences, although it is not possible to ascertain whether this is so because the studies were very different. Hallgren's figures can be assumed to be minimal ones, since he relied on the mothers' memory of events which occurred three years earlier. Moreover, it was explicitly stated that the questions asked of the mothers were concerned with the problem of bedwetting, and the stigma attached to this condition makes it unlikely that all cases of enuresis were reported.

Even when data have been based on information about current performance, reported frequencies have varied considerably from one study to another. Bransby, Blomfield and Douglas (1955) suggested that mailed questionnaires about present occurrences of bedwetting may also produce underestimated figures when compared with information from personal interviews. If we just consider those studies which used this latter means of eliciting information about current bedwetting, the number of four year old bedwetters has ranged from 12.2 percent (Blomfield & Douglas, 1956) to 22 percent (Oppel, Harper & Rider, 1968). Both these figures have included children whose bedwetting was infrequent, but occurred often enough for the mothers to comment.

MacFarlane et al. (1954) followed a small sample of children from infancy through to 14 years of age in order to study the prevalence of a number of childhood problems, including incontinence. Information was elicited from the mothers by intensive interviews at regular intervals throughout this study. Of 94 four year olds, 16.5 percent wet the bed at least once a month. However, with such small numbers the representativeness of their findings is in some doubt, especially since the sample was biassed towards the upper socioeconomic levels. This is an important consideration in view of the evidence that enuresis is more prevalent among children from lower socioeconomic or disadvantaged groups (Blomfield & Douglas, 1956; Hallgren, 1956; Oppel, Harper & Rider, 1968). On the basis of the above discussion, the commonly quoted estimate that about 20 percent of all four year olds wet the bed is probably not unreasonable (Jones, 1960; Lovibond, 1964; Werry, 1973).

Estimates of bedwetting prevalences among children in general vary from 8 percent among 5 to 15 year olds (Bransby, Blomfield & Douglas, 1955) to 18 percent in 6 to 12 year olds (Lapouse & Monk, 1964). The second estimate may be more accurate since it was derived from structured interviews with the mothers. This method yielded a reliability of over 90 percent during pre-tests. Bransby and his co-workers provided no information concerning reliability and did not describe the methods by which their data were collected.

The prevalence of bedwetting appears to decline steadily throughout childhood and into adulthood (Yates, 1970). Precise figures for each age group are impossible to determine because of variations in methodology and data in the various studies. Prevalence figures range from five to 23 percent at seven years of age, from five to eight percent at twelve years, and from two to three percent at 14 years. Israeli kibbutz children appear to have a lower prevalence of nocturnal enuresis after twelve years of age than their peers in other countries although they develop bladder control at a somewhat later age than usual (Kaffman, 1972). However, even this comparison could be in some doubt, considering the variations in methodology and definitions among the various studies.

Only four studies were found which looked at the incidence of faecal incontinence among children over three years of age, and none of these differentiated night-time and day-time soiling. The only study directed specifically at faecal incontinence was published by Bellman (1966), using a sample of 9253 children between seven and eight years of age attending Stockholm public schools. He found that 8.1 percent of the sample children were encopretic at three years of age. This figure decreased to 1.5 percent when the children were between seven and eight years of age. However, the data were gathered by questionnaire which required the mothers to remember past events, and the reliability of such data has already been questioned. MacFarlane, Allen and Honzik (1954) found only two boys, or 3 percent of their sample, who were soiling after three years of age. These boys both achieved bowel control by six years. The problem of bias in the small, dwindling sample of the MacFarlane study has already been noted.

Two further studies give incidence figures for a wider age range. Hallgren (1956), using retrospective information elicited from mothers by questionnaire, found that 8.9 percent of the survey sample were encopretic between three and eight years of age. Lapouse and Monk (1964) studied a random sample of children between 6 and 12 years of age, and avoided the problem of retrospective reports by using a structured interview with the mother to elicit information about current behaviour. They reported that 6 percent of their sample were encopretic, and of these, the majority were under eight years of age. All but this latter study found a majority of boys among the encopretic children.

Diurnal enuresis has rarely been studied. The few figures that are available come from studies, the primary concern of which was nocturnal enuresis. The general finding is that daytime wetting after four years of age is very rare compared with nocturnal enuresis (Blomfield & Douglas, 1956; Lapouse & Monk, 1964; Hallgren, 1956; MacFarlane et al., 1954; Oppel et al., 1968). The prevalence at five years has been found by different investigators to range from 1 to 8 percent. Prevalence decreases rapidly with age to between 1 and 4 percent at seven years, with a very small proportion wetting during the day by 12 years of age. Lapouse and Monk estimate that about 2 percent of children between the ages of 6 and 12 years of age wet during the day.

Despite the variability of methodology and data in the studies quoted, some general conclusions about incontinence among children can be drawn. There is a high incidence of nocturnal enuresis in comparison with daytime enuresis and faecal incontinence. Most children who wet during the day also wet at night, although day wetting is extremely rare after about seven years of age. Soiling is more frequent than day wetting. When children are incontinent of faeces they are usually incontinent of urine as well. Incontinence of any kind appears to be more frequent among boys than among girls, and tends to be more prevalent in the lower socioeconomic groups. However, the prevalence of all forms of incontinence drops to a very low value as children approach adolescence.

1.4.2. Incontinence in the mentally retarded

Incontinence is seen as a major problem among the mentally retarded, and a number of surveys have provided prevalence figures for this and many other characteristics of the retarded, as a preliminary to proposals for more appropriate services. Mental retardation is defined primarily for administrative purposes, in the pursuance of social welfare policies, as well as for scientific diagnosis, prognosis and research (Clarke & Clarke, 1974). Definitions vary across studies. However, the usual definitions are similar to those provided by the American Association on Mental Deficiency (Heber, 1959) and the World Health Organization (1967, 1968). The American Association on Mental Deficiency defines mental retardation as referring to "subaverage general intellectual functioning which originates during the developmental period and is associated with impairment in one or more of the following: (1) maturation, (2) learning, and (3) social adjustment." The WHO expert committee (WHO, 1968) put subaverage performance as two standard deviations below the population mean as assessed on one or more of the available objective tests of general intellectual functioning. This is usually associated with an IQ score of 70, or below, assuming a population mean of 100 and a standard deviation of 15 points, and accompanying evidence of onset under 16 years of age, and impairment of maturation, learning ability or social competence. This is the definition used in this report.

Retarded children by definition develop more slowly than non-retarded children. It is therefore reasonable to expect that they would acquire bladder and bowel control later than non-retarded children. One study demonstrated this by comparing 39 four-year-old Down's Syndrome children with 42 non-retarded four-year-olds, matched for age, sex and social class (Carr, 1974). By this age, 88 percent of the non-retarded children were clean and dry by day, compared with only 38 percent of the mongol children. In addition, 63 percent of the non-retarded children managed their toileting without help, compared with only 10 percent of the Down's children.

Surveys of incontinence among the retarded have not differentiated between day and night wetting or between wetting and soiling. Instead they have been concerned with incontinence as a global deficit. The usual purpose of such surveys has been to describe the range of deficits and problems which occur among retarded persons so that particular forms of help can be planned on the basis of need. For this reason, they have often concentrated on specific groups of retarded persons. For instance, a number of studies have looked at retarded persons in large institutions.

One study has attempted to estimate the prevalence of incontinence among the retarded population, as one of a number of incapacities suffered by the retarded (Bayley, 1973). Bayley's study included 1763 retarded persons of all ages on the Sheffield register, for whom full information could be gathered. Approximately 29 percent of this sample suffered from some incapacity concerning incontinence but this figure includes some who only needed help with toileting and were generally continent. Nevertheless, this indicates that incontinence is far more prevalent among the retarded that it is in the general population, for which the estimated prevalence is roughly 2 percent (Hald, 1975).

A number of studies provide prevalence figures for sub-groups of the retarded. These sub-groups are usually defined in terms of age, level of retardation and whether they live at home or in institutions. Most studies of both retarded and non-retarded samples have found that incontinence reduces as a function of age, but the retarded stand out as one section of the population who have a greater incontinence problem in childhood, and who maintain a much higher incidence of incontinence into adulthood. Calculating from data given by Bayley, 25.5 percent of retarded children and 19.1 percent of retarded adults were incontinent. A similar trend was also found in the Wessex survey (Kushlick, 1964; Kushlick & Blunden, 1974; Kushlick & Cox, 1967, 1968, 1973). Wing and Hayhurst (1974) surveyed retarded adults over 15 years of age. Using the Social and Physical Incapacity Scale developed by Kushlick, Blunden and Cox (1973), they found only 6.1 percent of their sample of 411 on the Camberwell Register who were severely incontinent. However, unlike the samples used in Bayley's study, this figure excludes those who wet or soiled occasionally but often enough to constitute a problem. These cases displayed some evidence of bladder and bowel control and were classified as partially incontinent. However, they still come within the definition of incontinence as used in this chapter and in Bayley's study. Wing and Hayhurst did not give prevalence data for this group and therefore an estimate of the full extent of incontinence in their sample is not possible.

Incontinence is strongly related to level of retardation (Smith & Sanderson, 1966). The British surveys all divide retardation into two levels: "severely subnormal" under I.Q. 50 and "mildly subnormal" over I.Q. 50. The incidence of incontinence is markedly different for these two groups. Bayley (1973) found 45.2 percent of the severely subnormal in his sample were incontinent, compared with only 1.6 percent of the mildly subnormal subjects. A similar large difference was also found in the other studies (Kushlick, 1964; Kushlick & Blunden, 1974; Kushlick & Cox, 1967, 1968, 1973; Wing & Hayhurst, 1974). The incidence of incontinence among the mildly subnormal groups appears to be much the same as in the general population, suggesting that incontinence is a major problem mainly among the severely subnormal.

There are a number of studies which have concerned themselves with the retarded in institutions as part of a more general examination of problems among the retarded. Some data are available on the factors leading to institutional admission, and incontinence is usually cited as a major factor (Bayley, 1973; McCoull, 1971; Smith et al., 1975). Bayley further analysed the precipitating factors and found that young children were usually admitted because of behaviour problems, deficiencies in toileting, walking, dressing and feeding, or severe epilepsy. Incontinence was second after behaviour problems as a primary reason for admission. For adolescents and young adults incontinence was fourth after behaviour problems, the need for supervision, and severe epilepsy. For older adults, incontinence became the major reason for admission once the parents were unable to care for them. The differential rates of incontinence among the retarded living in institutions and at home are quite striking with a greater proportion of the retarded in institutions being incontinent than those living at home (Bayley, 1973; Kushlick & Blunden, 1974; Kushlick & Cox, 1968, 1973; Wing, 1971; Wing & Hayhurst, 1974). This holds true for children, adults and the different levels of retardation, and occurs whether all the incontinent are included or only those with severe incontinence. The Camberwell study found that approximately 1 percent of retarded persons over 14 years of age who lived at home or in hostels were severely incontinent, compared with 19 percent of those living in institutions.

Since the prevalence of incontinence appears to be much the same in the mildly subnormal as in the general population, and few mildly subnormal children are placed in institutions (Bayley, 1973), comparisons between home and institution rates of incontinence are more revealing if only the severely subnormal are considered. Bayley found that, among severely subnormal children under 16 years of age, 47 percent of those living at home and 80 percent of those in institutions were incontinent. The prevalence among those over 16 years of age was much less, but still revealed a large difference between those at home and in institutions, with 12 percent of the former and 37 percent of the latter being incontinent. Wing (1971) reported on severely subnormal children under 15 years of age, using the same restricted definition of incontinence as Wing and Hayhurst (1974). Although the figures were much lower than in the Bayley study, they showed the same trend, with 14 percent of those living at home and 45 percent of those in institutions being severely incontinent.

These figures indicate that incontinence is a serious problem among the severely retarded whether they live at home or in institutions. However, incontinence outside institutions primarily affects individual families and does not become obvious until investigations such as those described above seek to discover the extent of the problem. In contrast, the congregation of large numbers of incontinent persons in institutions highlights the problem. A number of authors have described the results of incontinence in institutions in terms of negative attitudes about the retarded, high laundry costs, the problems involved in maintaining cleanliness and health, and the stress on staff who care for large numbers of incontinent persons (Dayan, 1964; Baumeister & Klosowski, 1965; Connolly & McGoldrick, 1976; Levine & Elliott, 1970; Yoeli & Scheinesson, 1976).

A group of studies has been specifically concerned with identifying the range of problems, including incontinence, with which residential services have to cope (Department of Health & Social Security, 1972; Eyman, Tarjan & Cassady, 1970; Lohman, Eyman & Lask, 1967; Parker, 1975; Tarjan, Wright, Dingman & Eyman, 1961). Estimates of the prevalence of incontinence in institutions range from 30 percent (Department of Health & Social Security, 1972) to 52 percent (Tarjan et al., 1961). Since similar definitions of incontinence were used in both studies, the variation in these estimates probably reflects differences in the sample characteristics. For example, only 10 percent of those included in the sample considered by the English survey were under 15 years of age (Department of Health & Social Security, 1972), whereas 56 percent of the sample in the Tarjan et al. study were under 14 years of age. Since the prevalence of incontinence in retarded persons decreases with age, this disparity probably accounts for a large part of the difference in the incontinence rates found by the two studies.

All surveys of incontinence in institutions show the usual negative correlation of incontinence with age and IQ. These factors are the most important, although incontinence also varies with diagnosis, physical handicaps, socioeconomic status and ethnic group, but not with sex (Tarjan et al., 1960, 1961). The lack of sex differences among the incontinent retarded is at variance with the findings for non-handicapped children, which have noted more boys than girls among those who are incontinent. These findings suggest that there may be different social influences related to sex involved in either the occurrence or the reporting of incontinence among non-handicapped children which are not involved when the incontinence is associated with retardation.

1.5. CONCLUSIONS

It is clear from this examination of the literature that, although incontinence is a problem in the general population, it is particularly so among the retarded. Bearing in mind the differences in definitions of incontinence, sampling methods, and sources of data, some idea of the relative disadvantage suffered by the retarded can be gained by comparing the available estimates.

Hald (1975) estimates that 2 percent of the total population are incontinent as compared with 29 percent of the retarded in Bayley's study (1973). The higher figure for the retarded is determined mainly by those under I.Q. 50. The prevalence of incontinence among the retarded with I.Q. scores over 50 is much the same as it is in the general population. However, not all severely subnormal persons are incontinent. Moreover, the decline of incontinence with age noted by the surveys of childhood incontinence also occurs among those under I.Q. 50. This suggests that incontinence is not an unalterable aspect of severe retardation, since bladder and bowel control can be acquired over time by more than half of this group. It further suggests a clear need to understand the nature of the problem for those retarded persons who remain incontinent and to develop appropriate treatment programmes which will reduce the problem.

CHAPTER 2.

THE INCONTINENCE SURVEY AT STRATHMONT CENTRE

2.1. INTRODUCTION

The prevalence data discussed in Chapter 1 indicated that incontinence is a serious problem for many retarded persons, and especially for those in institutions. Not only is incontinence high on the list of reasons for institutionalization in the first place, but persons who remain incontinent are also unlikely to be discharged from the institution (Eyman, Tarjan & Cassady, 1970). With the changing attitudes towards the retarded expressed in the normalisation principle (Nirje, 1969), there has been considerable pressure on institutions to develop procedures which will reduce incontinence among their residents as part of a general programme of independence training. Strathmont Centre was no exception. This institution was designed to provide a stimulating environment, training, and small group living for both children and adults. It was opened in 1971, with its first residents and staff coming from two psychiatric hospitals in the Adelaide metropolitan area. Planning for the toilet training research reported in this thesis began three years later.

It was generally believed by both staff and administrators in the institution, that the move to a new institution and increased staff ratios had resulted in considerable improvement in resident behaviour and independence, and that incontinence was no longer the major problem that it had been in the psychiatric hospitals. This was not as unreasonable assumption in the light of evidence from the U.K. for improved functioning in residential settings with person-oriented rather than institution oriented management. Examples of such evidence have been provided by Tizard and his colleagues (Tizard, 1964; King, Raynes & Tizard, 1971). They studied children who were cared for in both types of setting, and found that there were less behaviour problems and more advanced speech and feeding skills in the child-oriented units. This was so whether the units were small community based homes or part of a large institution. Toileting was not assessed in these studies. However, if its acquisition is affected by environmental factors, then it is likely that incontinence may also be reduced by person-oriented practices in institutions. Such differences in the social structure of institutions may have contributed to the different prevalence figures for incontinence in different institutional samples noted in Chapter 1. Hence, it cannot be assumed that incontinence will be a major problem in every institution, regardless of orientation.

The prevalence of incontinence in different institutions may also vary for other reasons. For example, admission policy may exclude incontinent persons, as was the case at Minda Incorporated, the other major institution for the retarded in South Australia. The rate of incontinence may also be low when direct care staff are encouraged to take a training rather than custodial role. This was the policy at Strathmont Centre, and direct care staff were therefore relieved of most domestic chores to allow them to fulfill a training role.

Failure to develop voluntary control over bladder and bowel functions is only one of many incapacities which occur frequently among retarded persons. Others include impairments in walking, hand and arm use, speech, self-care tasks such as dressing, feeding and bathing, and social and academic skills (Kushlick & Cox, 1968; McCoull, 1971; Tarjan, Dingman & Miller, 1960; Tarjan, Wright, Dingman & Eyman, 1961). Until the early 1950s these, and other problems which retarded persons might have, were widely regarded as due to genetic or disease factors and were therefore considered to be unmodifiable to any great extent (Kugel & Wolfensberger, 1969; Tizard, 1974; Tredgold & Soddy, 1956). However, this view has gradually been replaced by one which sees such impairments as resulting from a reduced capacity to learn. This view is based on experimental studies of learning and performance in the retarded and has been summarized by Clarke and Clarke (1974) as follows:

> "It seems to us that the most important general deficits in the severely subnormal are, firstly, a severe inability to learn spontaneously from ordinary life experience which includes social contacts with parents, peers and the community at large; secondly, there is almost always a severe language impairment; and thirdly, there is a considerable slowness in learning. Thus, if they are merely exposed to normal social and educational situations they will, on the whole, fail to profit from them. If, however, a situation or task is analysed for them and their attention directed to the relevant aspects by means of structured training, a very different picture will emerge." (p. 371).

It is this view which has informed the efforts to devise toilet training procedures for the retarded. Improvement in toileting has resulted from such procedures, thus adding support for the learning view. However, many investigators have failed to induce complete mastery in their trainees (Ando, 1977; Connolly & McGoldrick, 1976; Hundziak, Maurer & Watson, 1971; Kartye, 1972; Osarchuk, 1973; Rentfrow & Rentfrow, 1969). A learning interpretation of this failure suggests that the task analysis and training procedures were inadequate. However, it could also be interpreted as indicating an inability in the trainees to profit fully from training. It may be that training can overcome some of the deficiencies found among retarded persons, but that the amount of learning which can occur, even when training is provided, is limited by other dysfunctions which are organic in nature.

The existence of organic pathology is well documented in epidemiological studies of retardation. For instance, there is a high incidence of cerebral palsy and epilepsy, especially among the severely and profoundly retarded, who make up the bulk of those who are incontinent (Kushlick & Cox, 1968; McCoull, 1971; Tarjan et al., 1960, 1961). Both of these disorders may interfere with the motor control and neurological processes involved in toileting. Moreover, the existence of diseases, such as coeliac disease or chronic nephritis, which can also interfere with bladder or bowel control, was reported in a number of cases in the Newcastle-upon-Tyne regional survey (McCoull, 1971). Short term infections such as shigella also occur among incontinent persons and may interfere with bladder and bowel control.

In the prevalence studies reviewed in Chapter 1 incontinence associated with organic factors was not identified or differentiated from incontinence with no apparent underlying pathology. Similarly, most toilet training reports have not provided data on the presence or absence of organic pathology likely to interfere with bladder or bowel control. However, it has often been assumed that incontinent retarded persons are like incontinent, non-retarded children in that their problem is largely a learning rather than an organic one.

Because of the large variation in the rate of incontinence among institutions, and the lack of knowledge concerning the contribution of organic factors, it was considered desirable to survey the prevalence of incontinence at Strathmont Centre before introducing a programme of research into the efficiency of various training procedures. The survey described in this chapter was designed to provide basic information concerning the structure of the problem, and in particular to show the extent to which incontinence was associated with age, sex, general level of retardation, and the existence of organic pathology which may interfere with the acquisition of toileting skills.

The definition of incontinence used in this survey was outlined in Chapter 1, and includes both frequent and occasional wetting or soiling. Two major studies reported incontinence based on similar definitions. In the 1970 National Survey of Mentally Handicapped Patients in Hospital in England and Wales (Department of Health and Social Security, 1972) both frequent (more than once a week) and occasional incontinence (once a week or less) were recorded. Figures from Pacific State Hospital in California were based on those who had some "daytime untidiness" (assumed to indicate occasional wetting or soiling) or who regularly soiled or wet (Eyman et al., 1970; Lohman, Eyman & Lask, 1967; Tarjan et al., 1961). Therefore, the findings from these two studies will be compared with those from this survey.

2.2. METHOD

The survey was carried out over a four month period. Information concerning level of retardation and age was taken from each resident's case notes. In addition, other case note information likely to have a bearing on incontinence was noted. The presence or absence of incontinence in each resident was then ascertained by interview with a member of staff who had worked directly with the resident for at least the preceding month. The case note information was used to generate questions during the interview when answers were ambiguous. Other members of staff were questioned where a respondent appeared unsure about a particular resident's voiding behaviour.

Information about organic pathology was provided by the medical staff of the Centre who at the time of this survey were establishing a complete medical record for each resident, and had nearly completed this work in the children's units. Therefore it was decided that reliable data on organic conditions would not be available for the older residents. For this reason, the medical information was only collected for residents of 20 years of age and younger.

2.2.1. The Survey Population

The population of Strathmont Centre during the few months of the survey totalled 611 residents. These included 542 adults and children who had been admitted prior to the survey, and 69 adults who were admitted during the survey period. These were the last residents to be transferred to Strathmont Centre from a psychiatric hospital. The characteristics of the population are defined in Table 2.1 in terms of sex, age, and level of retardation. Age and level of retardation were not ascertained in a few

TABLE 2.1. Characteristics of the 611 residents at Strathmont Centre, South Australia, in 1974 during the months of May through August.

Characteristic	Category	Frequency
Sex	Male	327
	Female	284
Age	20 years & under	303
	21 years & over	299
	Not ascertained	9
Retardation Level	Mild	73
	Moderate	143
	Severe	230
	Profound	157
	Not ascertained	8

cases because this information was not available either from the case notes or from relatives or staff. In all cases where level of retardation was not ascertained, severe behaviour problems prevented either the administration of an intelligence test or estimation of the level of functioning.

2.2.2. Variable definitions

Data on date of birth, sex and level of retardation were taken from the individual case notes of each resident. Age at the time was calculated in years and months. The definition and classification of retardation used by the institution was based on the World Health Organisation International Classification of Diseases, Injuries and Causes of Death (WHO, 1967). Persons were eligible for admission if they had an I.Q. score of 70 or below, as measured by an individual test of intelligence. However, I.Q. was not used in this survey as many residents had not been tested. Instead the less rigorous classifications of mild, moderate, severe and profound retardation were used, since all residents had been categorized in this way. The categories entered in the case notes had usually been derived from test scores, but in some cases where no test reports were available the categories were based on clinical judgement. Where an I.Q. score was available the retardation level was determined as follows: mild: I.Q. 52-70, moderate: I.Q. 36-51, severe: I.Q. 20-35, and profound: I.Q. of 19 or below.

Organic conditions likely to interfere with the achievement of continence were defined with the help of the senior medical officer, and a form devised to be completed for each resident under 21 years of age under the supervision of a medical officer (see Appendix 2.1). The existence of one or more of the following conditions was recorded:

Poorly controlled epilepsy (more than five seizures a month during the last three months);

Spinal cord dysfunction and possible associated neurogenic bladder;
Chronic constipation or diarrhoea;
Coeliac disease;
Rectal malfunction (e.g. bowel prolapse or unresponsive internal sphincter);
Urinary infection;
Renal malfunction (e.g. kidney failure);
Unable to walk across a room without support;
Unable to grasp or release voluntarily with both hands;
Visual defect (cannot see enough to recognize a person);
Hearing defect (cannot hear normal speech);
Any other condition likely to interfere with toileting.

Routine urinanalysis, micro-urine and culture, multi-12 tests for urea and creatinine levels and rectal examinations were performed. Where these tests or other symptoms suggested an undiagnosed condition, further tests were carried out, and the resident referred to a medical specialist if necessary.

The definition of incontinence used was as outlined in Chapter 1, referring to the frequency and place of uncontrolled voiding as well as the age of the individual. These aspects were operationally defined for the purpose of this survey. Reported urinations or defecations which occurred in any place other than the pot or toilet were considered to be incontinent episodes. However, as was noted in Chapter 1, occasional incontinence is experienced by many people and is not usually considered to indicate lack of voluntary control. Preliminary discussions with staff indicated that residents who had incontinent episodes every few weeks or less usually did so because of factors other than lack of voluntary control. Examples of such factors included epileptic seizures, being shut in a room as punishment, absence of toilets for long periods during an outing, and severe illness. Therefore, episodes were not classified as incontinence unless they occurred at least once a fortnight.

By four years of age most children have acquired acceptable bowel and bladder control (Lovibond & Coote, 1970). Therefore, children below this age would not ordinarily be regarded as having a problem and should not be included in data concerning the prevalence of incontinence. Since no children in the institution were younger than four years of age at the time of this survey, no cases were excluded by virtue of age.

2.2.3. The Interview

An unstructured interview technique was used to elicit information about voiding and toileting behaviour, and this information was then used to classify residents as either continent or incontinent. Examples of the types of questions asked are provided in Appendix 2.2. At the beginning of the interview the nature of the survey was explained. Staff were told that it was one of a number of investigations designed to discover the range of resident behaviour exhibited in a number of routine situations so that future planning would be realistic. It was emphasized that this survey was concerned with the kinds of voiding behaviour staff had to handle in their daily work. They were reassured that their identity would not be revealed, and that wetting and soiling among their charges was not seen as a reflection on their skill. Questions concerning incontinence were interspersed with questions about toileting. This arrangement of questions was considered necessary, since many members of staff held idiosyncratic views concerning the voiding and toileting patterns which were acceptable. For example, many respondents considered residents to be toilet trained who usually voided in the toilet when taken even though they also voided in their pants on a number of occasions.

The interview sought to establish whether any voiding episodes had occurred in places other than the toilet during the previous month. If the answer was no, additional probe questions were asked. These were intended to counter the tendency to ignore those episodes which the respondent considered to be unavoidable. These included voiding which occurred on the way to the toilet, while being undressed or when the resident was outside. If non-toilet voiding was reported, further questions were asked to determine whether it indicated incomplete bladder or bowel control. For example, instances of involuntary voiding only during epileptic seizures or acute bouts of diarrhoea were not considered to indicate incontinence. Similarly, inctontinence was not indicated in a non-verbal resident who was normally continent but had isolated voiding accidents in situations where there was no access to a toilet for long periods.

Reliability of the ratings of continence and incontinence was tested in four eight-bed units in different parts of the institution. A second person interviewed members of staff who had not been interviewed by the author, and rated the 32 residents accordingly. Interrater reliability was found to be 95 percentage agreement. This was the method recommended by Kushlick, Blunden and Cox (1973) when the statistical distribution of scores could not be assumed to be normal.

2.3. RESULTS

The first question which the survey sought to answer concerned the overall prevalence of incontinence in the institution. Table 2.2 indicates that over half the residents were classified as incontinent during the month preceding the interview. Classification of 14 cases was not possible because they were away from the Centre for at least two weeks prior to the interview, due either to hospitalization or family holidays.

TABLE 2.2. Frequency of incontinence among the 611 residents at Strathmont Centre

	Frequency	Percentage of Ascertained Cases
Continent	271	45.4
Incontinent	326	54.6
Not ascertained	14	
Total	611	

Other questions concerned the relationship of incontinence with sex, age, levels of retardation, and the existence of organic pathology likely to interfere with the achievement of continence. To examine these relationships, crosstabulations and derived statistics were obtained using the Statistical Package for the Social Sciences (Nie, Hull, Jenkins, Steinbrenner & Bent, 1975). The measure of association used was Tau (Tau "c" in the programme). It is a measure of ordinal correlation with correction for ties, appropriate when the form of the association may not be linear. It may be interpreted as a rank correlation value.

There were no sex differences in the proportion who were incontinent (Chi Square = 0.16, d.f. = 1, $p > .50$). However, incontinence was significantly related to age and retardation level. Incontinence was progressively less likely as age increased (see Table 2.3). The majority of the incontinent (60.5%) were under 20 years of age. The value of Tau was -.33 ($p < .01$). The relationship of incontinence with retardation level was even more marked than with age, with 84.3 percent of the incontinent among the severely and profoundly retarded groups (see Table 2.4). The value of Tau was .58 ($p < .01$).

TABLE 2.3. Frequency of incontinence within each age group.

Age Group (in years)	Number Incontinent	Percentage of Ascertained Cases
-10	70	81.4
11-20	126	58.3
21-30	73	61.3
31-40	17	34.0
41-50	23	39.0
51-60	13	29.5
60-	2	12.5
Not ascertained	2	
Total	326	

TABLE 2.4. Frequency of incontinence within each level of retardation.

Level of Retardation	Number Incontinent	Percentage of Ascertained Cases
Mild	10	14.1
Moderate	40	28.4
Severe	133	58.8
Profound	135	89.4
Not ascertained	8	
Total	326	

It is possible that the younger residents were also the most retarded in the population, and that this confounded the relationship of both age and retardation level with incontinence. Therefore, a further analysis was made of incontinence in relation to age, while controlling for retardation level, and in relation to retardation level with age controlled. The negative relationship with age remained within each level of retardation as follows: for profoundly retarded, Tau = -.19 ($p < .01$); for severely retarded, Tau = -.44 ($p < .01$); for moderately retarded, Tau = -.32 ($p < .01$); and for mildly retarded, Tau = -.07 (N.S.). It may be noted that the number of mildly retarded was too small, given their low incontinence rate, to allow any clear test of the age relationship within that retardation category. The relationship with retardation level was analysed separately for the younger (up to 20 years) and the older residents (21 years or more). Incontinence was significantly related to retardation level in both age groups, with Tau values of .63 and .56 ($p < .01$) respectively.

These relationships are shown clearly in Figure 2.1. The majority of the profoundly retarded remained incontinent well into the adult years, and the majority of severely retarded did not achieve continence until early adulthood. In contrast, most of the moderately and mildly retarded became continent during childhood or adolescence. The figure also shows several increases in the incontinence rate among the adult residents which require some explanation.

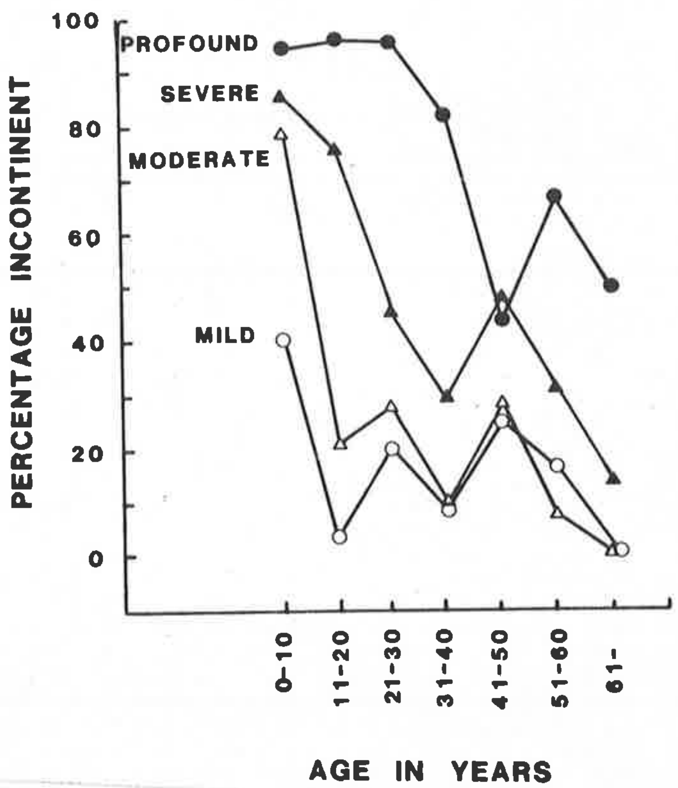


FIGURE 2.1. The relationship of incontinence with age and retardation level.

Medical assessments were carried out for residents under 21 years of age. There were 303 residents in this group. Five were absent from the Centre during the medical assessments, leaving 298 cases. A sizeable proportion of this group (108 or 36.2%) were found to suffer from organic conditions considered likely to interfere with the achievement of continence. The existence of such conditions was highly predictive of incontinence. Table 2.5 shows that 95.4 percent of those with demonstrable organic conditions were also incontinent, compared with 46.8 percent of those who had no such conditions (Chi Square = 68.66, d.f. = 1, $p < .01$).

TABLE 2.5. Frequency of incontinence among residents under 21 years of age with and without organic conditions.

	Number Incontinent	Percentage of Ascertained Cases
Organic conditions	103	95.4
No organic conditions	89	46.8
Not ascertained	4	
Total	196	

Apart from establishing that organic conditions were indeed associated with incontinence, this finding raises a question concerning the interpretation of the findings related to age and retardation level. It may be that the higher incidence of incontinence among the younger and more retarded residents simply reflects a higher incidence of organic conditions in these groups. To determine this point, further analyses were undertaken of the relationship of incontinence with age and retardation level for those cases <u>without</u> associated organic conditions. These analyses could only be done, of course, for cases under 21 years of age for whom organic conditions had been ascertained.

Table 2.6 shows that organic conditions were evenly distributed among the younger and older residents (Tau = .03, N.S.), but occurred more frequently at the lower levels of retardation (Tau = .58, $p < .01$), with 78.6 percent occurring in the profoundly retarded category. For those cases without organic conditions, incontinence was still negatively associated with age, as shown in Table 2.7, despite the restriction to cases under 21 years of age (Tau = -.26, $p < .01$). Similarly, the relationship between incontinence and retardation level for only those cases without organic conditions remained significant (Tau = .61, $p < .01$).

TABLE 2.6. The distribution of organic conditions likely to interfere with the achievement of continence by age group and retardation level in residents under 21 years of age.

		Frequency	Percentage with Organic Conditions
Age Group (in years)	-10	86	39.5
	11-20	212	35.4
	Not ascertained	5	
Retardation Level	Mild	36	2.8
	Moderate	73	11.0
	Severe	113	34.5
	Profound	70	78.6
	Not ascertained	11	
Total		303	

TABLE 2.7. The relationship of incontinence with age and retardation level among residents under 21 years of age with no demonstrable organic conditions likely to interfere with the achievement of continence.

		Frequency	Percentage Incontinent
Age Group (in years)	-10	52	71.2
	11-20	137	28.8
	Not ascertained	6	
Retardation Level	Mild	35	8.6
	Moderate	65	29.2
	Severe	74	68.9
	Profound	15	100.0
	Not ascertained	6	
	Total	195	

2. 4. DISCUSSION

The overall prevalence of incontinence in this survey (54.6%) was much the same as the prevalence for new admissions to Pacific State Hospital during 1948-1952 (52%) (Tarjan et al., 1961). A much lower figure was reported in the National Survey in England (30%) (Department of Health and Social Security, 1972). The marked disparity in these figures is probably partly due to different resident characteristics in the different institutions. Calculations from the raw data reported in the National Survey show that only 17 percent of patients in British hospitals were under 20 years of age, whereas 83 percent of the Tarjan et al. sample were under 18 years and 50 percent of the Strathmont Centre residents were under 21 years of age. Moreover, the proportion of mildly retarded residents in the three surveys differed. The mildly retarded accounted for 32 percent of the British patients, 36 percent of the Pacific State Hospital sample, but only 12 percent of the Strathmont residents. Most surveys, including the one reported here, have found that incontinence is negatively correlated with age and is more prevalent among the lower levels of retardation. Therefore, the higher rate of incontinence at Strathmont Centre and Pacific State Hospital probably reflected the larger number of both children and very retarded children in the two institutions. Other environmental and methodological differences may also have influenced the incontinence rates in the three studies. However, it is not possible to assess the contribution of these factors. Nevertheless, it is interesting to note that, despite these possible differences, the prevalence figures from both the Pacific State Hospital sample and Strathmont Centre were very close.

The relationship of incontinence with factors such as sex, age and retardation level has been considered by several investigators, and this study confirms their findings. There appears to be no relationship with sex. Rather, incontinence is equally distributed among males and females (Tarjan, Dingman & Miller, 1960; Tarjan et al., 1961). This is contrary to the findings in relationship to non-handicapped children, among whom more boys are represented in prevalence figures for incontinence than girls (Schaefer, 1979; Werry, 1973). However, all surveys of retarded persons which have considered incontinence have found that it decreases significantly as age and I.Q. increase. Moreover, the Strathmont figures indicate that the decrease with age occurs at all levels of retardation and that the association of incontinence with retardation level remains throughout the life span. About 60 percent of the moderately, severely and profoundly retarded in the Strathmont sample, as well as in the group studied by Tarjan et al., were incontinent. Again, the English figure was much lower (39%). This difference is probably due to the much higher percentage of adults in the English sample.

It is not possible to compare the actual incontinence figures at different ages as the age groupings were different in each study.

A detailed examination of the results from the Strathmont study suggests that other factors are also involved. Figure 2.1 shows several upturns in the reducing incontinence rate with age. These occurred among the 20 to 30 year old mildly and moderately retarded, the 40 to 50 year old severe to mild groups, and the 50 to 60 year old profoundly retarded residents. These trends may reflect variations in admission rates which were not considered in this survey. However, other studies have investigated factors which lead to institutional admission at different ages. They have found that those admitted as children generally show severe degrees of retardation, and are highly likely to be incontinent (Tarjan et al., 1961). Those who are less retarded are more often admitted in adolescence or early adulthood for a number of reasons, incontinence being one (Bayley, 1973). This may explain the upturn in incontinence among the 20 to 30 year old, mildly and moderately retarded groups shown in Figure 2.1. For older adults, incontinence becomes a major factor determining admission (Bayley, 1973). Admissions for this reason may account for the peak in incontinence among the 40 to 60 year old severely and profoundly retarded residents.

One factor which was investigated in this study was the likelihood of organic involvement. Various chronic diseases and physical or neurological dysfunctions are more prevalent among the retarded than in the general population (McCoull, 1971), and may have a considerable influence on the ability of an individual to control his or her own toileting. Little attention has been given to this factor in the literature on incontinence and toileting in the retarded, although Eyman et al. (1970) noted that 60 percent of incontinent residents in their sample who did not improve in toileting ability over a three year period had types of retardation associated with somatic pathologies. Therefore, data were collected during this survey on the existence of chronic conditions which were considered likely to interfere with the achievement of continence. Since these data were only available for residents under 21 years of age discussion of this factor will be limited to that age group.

The only other study of incontinence which considered organic involvement was done by Lohman, Eyman and Lask (1967). Although they did not directly attempt to relate organic conditions with incontinence, their data suggested that such factors could contribute significantly to the prevalence figures. The findings at Strathmont Centre confirm this.

More than a third of this group suffered from one or more of the conditions included on the medical form. Moreover, these organic conditions together were highly associated with incontinence, since all but five cases with organic involvement were also incontinent. Although the existence of such conditions does not necessarily indicate that improvement in bladder or bowel control cannot occur, it does suggest that in a significant proportion of young institutionalized retarded persons toilet training may not be the most effective or the only way of handling incontinence. In some instances, training would be totally inappropriate. For example, a number of individuals who could not walk across a room alone were frail, and required constant nursing care. In other cases with spina bidifa, the medical opinion was that the spinal cord dysfunction made voluntary control of bladder and bowel functions impossible. For this reason, urinary bypass surgery is common among children with spina bifida in South Australia, and several of the Strathmont residents had undergone this operation.

The extent to which acquisition of voluntary control may be possible when incontinence in the retarded involves organic pathology has not been tested, although there are isolated reports of improvement with training. Butler (1976a) made considerable modifications to the toilet training programme designed by Foxx and Azrin (1973b) in order to adapt the procedures to the particular difficulties experienced by a child with spina bifida. Training with these procedures enabled the child to develop partial control over his bladder, and take responsibility for cleaning up after bowel accidents. Different modifications were introduced to adapt the same programme for a profoundly retarded blind boy with considerable success (Song, Song & Grant, 1976). These two cases suggest that the acquisition of some voluntary control is possible, despite the existence of organic involvement, when those conditions are taken into account in the design of training procedures. In other instances, training may be effective after other measures have alleviated the effects of the conditions. For example, dietary control or drug treatment may relieve chronic diarrhoea, while motor training and physiotherapy may bring about walking and hand use, after which toilet training may be feasible. The data collected during this survey do not permit any conclusions as to whether incontinence with associated organic conditions will respond to training. However, the results do indicate that the size of the group with organic involvement warrants further research into procedures specifically designed to improve voluntary bladder and bowel control in persons with these conditions. Such procedures may involve a combination of approaches rather than the purely behavioural approach employed in most toilet training.

The majority of the profoundly retarded and a third of the severely retarded suffered from organic conditions likely to interfere with the achievement of continence, compared with very few of the mildly and moderately retarded. This suggests that organic pathology rather than general learning difficulties may account for the higher prevalence of incontinence in the former groups. However, when those suffering from organic conditions were excluded from the analysis, the relationship of incontinence with age and retardation level was still significant.

Several possible explanations for these findings come to mind. One possibility is that all incontinence in the retarded has an organic basis, but that some conditions were not accounted for during the medical assessment. This would account for the increased frequency of incontinence as the severity of retardation increased, since the distribution of those organic conditions which were observed followed this pattern. However, the organic theory does not account for the reduction in incontinence with age in the undiagnosed cases. Where organic conditions were diagnosed, incontinence was spread evenly among the age groups, whereas in the groups with no diagnosed conditions the reduction with age was quite marked.

An alternative explanation, which accounts for the relationship of incontinence to both age and retardation level, argues that maturation is delayed in retarded persons, with the greatest delay occurring among the most retarded individuals. Maturation is "an orderly destined process of growth and elaboration of structures and functions within the central nervous system . . . . which cannot be accelerated by environmental influences; [although] it can be delayed by injury to or defective development of the brain" (MacKeith, Meadow & Turner, 1973, p. 9). Delayed maturation of the necessary mechanisms has been postulated by some authors as the reason for the absence of bladder control after the age of five in non-handicapped children (Bakwin & Bakwin, 1972; Illingworth, 1968). It could be argued that increasing retardation involves increasingly delayed maturation, thus resulting in the higher prevalence of incontinence found among the retarded and the lower levels of retardation. This theory would account for the decrease in incontinence with both age and IQ. However, it cannot explain the existence of some continent cases at all levels of retardation within each age group.

MacKeith and his colleagues argue against the maturation theory in relation to non-handicapped children on two grounds. First, there is no way of finding out whether maturation of the necessary central nervous system mechanisms has failed to occur. If continence has been achieved, then the mechanisms must have matured, but failure to achieve control cannot necessarily be taken to indicate that maturation is not complete. Second, most children with urinary incontinence have some periods of dryness, which may be regarded as evidence that the mechanisms required for voluntary control are present (Miller, Court, Walton & Knox, 1960). The impression gained during the interviews at Strathmont Centre was that most of the incontinent retarded without organic conditions also showed some signs of control, as indicated by long periods between voidings, or frequent instances of voiding in the toilet when they were taken. However, the possible contribution of delayed maturation in some cases cannot be ruled out, as MacKeith and his colleagues point out, although how this hypothesis could be tested is not clear.

This leaves the hypothesis that incontinence in the retarded who show no sign of organic involvement is due to a reduced capacity to learn from ordinary experience. It may be argued that the greater the retardation, the more ineffecient this learning will be, hence the greater prevalence of incontinence with increasing degrees of retardation. A reduced capacity to learn may also be compounded in institutions, as demonstrated by a number of investigators (Bayley, Rhodes & Gooch, 1966; Elliot & MacKay, 1971; Lyle, 1960; Mitchell, 1955). However, even the most retarded in institutions can acquire the necessary controls in time, as evidenced by the marked decrease in incontinence with age in a number of institutional samples. Nevertheless, some individuals do not develop this control. It may be that, among those with similar degrees of retardation, the likelihood of becoming continent depends on the types of learning environments experienced rather than on characteristics residing in the individual. If this theory is correct, the slow rate of change produced by the inefficient learning routines which underly the observed age trends may be accelerated by training. However, training would have to restructure the environment in ways which will compensate for reduced learning capacities.

The prevalence figures provided by this and other institutional studies must be regarded as specific to institutional populations and cannot be considered as representative of the retarded population in general. The majority of retarded persons live in the community (Kushlick & Blunden, 1974), and it is known that they have a much lower rate of incontinence than those in institutions (Bayley, 1973; Wing, 1971; Wing & Hayhurst, 1974). Nevertheless, the same trends with age and retardation level have been found to occur among both groups (Bayley, 1973; Kushlick, 1974). Therefore, the reasons for incontinence and the procedures which will reduce it are probably much the same whether or not the individual has been institutionalized.

A number of conclusions can be drawn from the results of this study.

Incontinence is a problem which affects a large proportion of retarded persons in institutions, and Strathmont Centre was found to be no exception. The size of the problem for any one institution depends on the characteristics of its population. Thus, incontinence is more prevalent among younger age groups and among those with greater degrees of retardation. Measures which effectively reduce incontinence in these groups would therefore considerably alter the problems which institutions face.

Organic conditions accounted for over half of the incontinence in the under 21 year olds at the time of this study. Additional data are necessary to establish the contribution of organic factors among adults. This finding has implications for the kinds of measures which may be effective in reducing the problem, and suggests that a number of approaches may be necessary. It can reasonably be suggested that, among those with no apparent organic involvement, incontinence is the result of inefficient learning. The solution in these cases is most likely to come from training procedures aimed at establishing bladder and bowel control. It is this type of incontinence which is the subject of the following chapters.

CHAPTER 3.

TOILET TRAINING AND THE ACQUISITION OF BLADDER AND BOWEL CONTROL

3.1. INTRODUCTION

This chapter is concerned with the procedures which have been used to bring about voluntary bladder and bowel control in incontinent persons when there is no apparent underlying organic pathology. This type of incontinence occurs mainly among non-handicapped children and retarded persons. Therefore these will be the two groups on which the discussion will centre.

A number of different approaches to treatment have been described in the literature. Each is based on a particular conception of the nature and cause of incontinence. Theorists with a medical background generally emphasize physiological causes, such as inefficient or immature neurological functioning, disturbed muscular action in the urinary tract or bowel, or undetected malformations or infections (Caldwell, 1975; Schaefer, 1979; Shuttleworth, 1970; Werry, 1973). Treatments arising from physiological theories often involve the use of drugs which act either directly on the urinary tract or lower intestine or on the central nervous system. Psychodynamic theories see incontinence as a symptom of underlying emotional disturbance. They advocate psychotherapy directed at the emotional problems rather than direct treatment of the incontinence (Anthony, 1957; McTaggart & Scott, 1959; Pinkerton, 1958; Richmond, Eddy & Garrard, 1954; Sperling, 1965; Woodmansey, 1967). Behavioural theories emphasize faulty learning which may occur for a number of reasons. Possible reasons include anomalies of neural development, the absence of environmental conditions necessary for the acquisition of voluntary control, low levels of conditionability, and the presence of environmental conditions which interfere with learning (Lovibond & Coote, 1970).

The view that faulty learning underlies most incontinence has been the one most commonly advocated in the literature over the past two decades, and has led to treatment approaches based on the principles of conditioning, especially in relation to the retarded. Incontinence occurs in several forms. It can occur during sleep or during the waking state, and it can involve either urinary or faecal incontinence. Non-handicapped children often suffer from only one of these forms of incontinence, with urinary incontinence during sleep being the most common. Retarded persons frequently suffer from all forms of incontinence. However, day time wetting and soiling in the retarded has attracted most attention. The most common approach to the treatment of day time incontinence in both non-handicapped children and retarded children and adults has been the provision of toilet training based on conditioning principles. These are the procedures which will be examined in this chapter.

3.2. THE DEVELOPMENT OF CONTINENCE

An analysis of how continence is achieved requires an understanding of the mechanisms involved in the voiding of urine (micturition), the voiding of faeces (defecation) and the inhibiting of these processes. A brief outline of these mechanisms follows.

Urine is formed in the kidneys and discharged continuously into the bladder through two small ducts known as the ureters. A small membrane at the mouth of each ureter where it enters the bladder serves to prevent a backflow of urine during bladder contractions. The bladder is a collapsable storage bag surrounded by smooth muscles, known collectively as the detrusor.

These muscles are extremely elastic and the bladder can expand from a volume of as little as 1 millilitre to almost 1 litre. During filling, the tone of the detrusor is repeatedly adjusted to permit large increases in volume with little increase in internal pressure. The volume of a normal adult bladder can be increased to approximately 300 millilitres before an increase in bladder pressure becomes apparent. Further distention of the bladder brings about rhythmic contractions of the destrusor.

The amount and rate of urine discharge from the kidneys into the bladder depends upon such factors as the amount of fluids and solids consumed, temperature and humidity, the amount of exercise, the health of the individual and emotional stress. With rapid filling of the bladder, pressure builds up quickly and the urge to urinate is quite strong. When the bladder fills slowly a considerable amount of pressure can be tolerated (Schaefer, 1979).

Urine leaves the bladder through a tube known as the urethra. The upper part of the urethra is composed of smooth muscle which is continuous with the base of the detrusor. This is known as the internal sphincter and is arranged so that, when the detrusor contracts, it relaxes. Contraction of the internal sphincter automatically follows relaxation of the detrusor. This provides a resting tonus sufficient to prevent urine leakage until relaxation occurs again in response to detrusor contractions (Tanagho, 1975). Thus internal sphincter action cannot occur independently of detrusor relaxation and contraction (Denny-Brown & Robertson, 1933). However, it is only after detrusor contractions are well under way that sphincter relaxation occurs (Doyle, 1975).

The distal portion of the urethra is known as the external sphincter, and is associated with the voluntary muscles of the pelvic floor. Although able to be controlled voluntarily, this group of muscles tends to relax in response to bladder pressure and the flow of urine into the urethra. Once both sphincters are relaxed, micturition occurs. A continued flow of urine through the urethra serves to stimulate further contractions in the detrusor. The micturition process thus involves a series of simple reflexes controlled from centres in the hind-brain and the sacral region of the spinal cord (Lovibond, 1964).

The way in which these processes are brought under voluntary control is not fully understood (Doyle, 1975). It is known that several centres in the cerebral cortex are related to micturition, but how they relate to the reflex pathways and the urinary tract itself has not been described (Kuru, 1965). Nevertheless, most people learn to both inhibit urination beyond the point of the first sensations of urgency and bring about urination voluntarily at low bladder volumes. Inhibition of urination is achieved by voluntarily contracting the muscle group known as the levator ani. These are sited in the perineum which runs under the trunk between the legs. This action elevates the bladder neck so that urine in the urethra empties back into the bladder and closure of the internal sphincter occurs (Muellner, 1958; Vincent, 1959). It is likely that detrusor contractions cease as a result of this manoeuver, and the urge to void therefore wanes. The ability to exert inhibitory control probably assists the increase in bladder capacity and the lengthening time between urinations which occur during early childhood (Gershenfeld, 1943).

The mechanisms employed to voluntarily induce urination appear to involve the co-ordination of several muscle groups. The evidence of Muellner (1958, 1960a, 1960b) and Vincent (1964) suggests that the thoracic diaphragm is held steady while the lower abdominal muscles are contracted. This brings pressure to bear on the bladder and induces the detrusor to contract. At the same time the perineal muscles are relaxed, thus allowing the bladder neck to descend. This causes the internal sphincter to open and stimulates the necessary reflexes so that micturition occurs.

Bowel control similarly appears to involve interaction between voluntary and reflex action, although the mechanisms involved have not elicited as much interest among behaviourists. This is understandable as soiling is relatively rare compared with enuresis. However, the process of defecation has been described by some authors (Schuster, 1968).

The food mass passes from the stomach into the small intestine. It takes three and half to five hours to move through this section of the digestive tract. Digestion is almost complete by the time the mass passes into the large intestine or colon. The mass is in a semi-liquid state at this stage. Both liquid and some undigested nutrients are absorbed by the colon, leaving the waste or faecal mass to continue through to the rectum. Movement through the digestive tract is accomplished by wavelike motions in the walls known as peristaltic contractions. These contractions occur relatively infrequently in the large intestine. Their occurrence is partly dependent on nervous pathways and partly stimulated by a hormone secreted from the stomach (Young, 1973).

The ingestion of food or liquid stimulates a peristaltic "rush", forcing the contents of the colon towards the rectum. This is known as the gastro-colic reflex. The intake of food or liquid also stimulates increased activity in the rectum, thus forcing the faecal mass towards the outlet. This is known as the gastro-ileal reflex (Young, 1973). Distention of the rectum by incoming faeces leads to reflex relaxation of the internal sphincter at its outlet. Faeces is finally passed by way of the external sphincter, which appears to be associated with the voluntary muscles of the pelvic floor in much the same way as the distal portion of the urethra. The external sphincter tends to contract as relaxation of the internal sphincter occurs (Engel, Nikoomanesh & Schuster, 1974), resulting in cessation of colonic and rectal activity. As faeces passes through the internal sphincter, the muscles involved in the external sphincter relax, allowing the faeces to finally pass out of the body.

Information about the voluntary control of these processes is not readily available. However, it has been suggested that it involves the same muscle groups used in bladder control (Muellner, 1960b). The urge to defecate, which is felt when additional faecal material arrives in the rectum, can be resisted. The way in which this is achieved has not been described. It is likely that voluntary contraction of the pelvic floor is involved. When defecation is inhibited, reverse peristalsis causes the faecal mass to move back into the lower colon (Schaefer, 1979).

Alternatively, defecation can be voluntarily assisted by steadying the thoracic diaphragm and directing voluntary contraction of the abdominal muscles towards the rectum (Muellner, 1960b). Presumably voluntary relaxation of the pelvic floor and external sphincter also assists.

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 occasional failures during acquisition, but with an increasing success rate as the child becomes older. In addition, there are individual differences in the time taken to achieve final control. The various skills involved in bladder control appear to be acquired in an orderly sequence (Muellner, 1960a, 1960b), and Yates (1970) suggests that the process is similar for bowel control. No analyses of this process in relation to bowel control could be found. However, Muellner describes the development of bladder control in the following way.

1. Infants begin life with reflex voiding of bladder and bowel. These reflexes are triggered by the filling of the bladder or bowel, which then sets off rhythmical contractions and spontaneous voiding. Bladder and bowel capacity is small so that spontaneous voiding is frequent during the first few months of life.

2. As a result of the maturation of the parasympathetic nervous system most children learn to perceive stimulation from increasing bladder tension between one and two years of age. At this stage many children show behavioural signs of approaching voiding. With this awareness, the ability is acquired to "hold" urine for a brief time after the sensation of a full bladder is perceived, and bladder capacity is virtually doubled (see Table 3.1). Once this stage is reached children can learn to resist the urge to void long enough to get to the toilet. People who suffer from delayed maturation or deficient nervous system functioning may not develop this ability to perceive bladder tension, and this will interfere with the acquisition of bladder control.

3. By three years of age most children have learned to hold urine for a considerable time when the bladder is full. This requires the voluntary tensing of the perineal muscles, which raises the bladder neck, and tightens the internal sphincter (Muellner, 1958; Vincent, 1959, 1960, 1964, 1966). This further increases bladder capacity so that there is a marked drop in frequency of voiding and a greater quantity voided at each elimination (see Table 3.1).

TABLE 3.1. Frequency and quantity of urinary voiding distributed by age (Gershenfeld, 1943).

Age	Mean Daily Frequency	Quantity (c.c.)
Under 3 months	13.5	29.6
3-6 months	20.0	29.6
6-12 months	16.0	44.4
1-2 years	12.0	59.2
2-6 years	8.7	88.8
6-8 years	7.4	148.0
8-11 years	7.1	207.2
11-13 years	7.9	222.0
Adults	7.0	192.4

4. Between three and four years of age the ability to voluntarily start the urine flow from a full bladder is acquired. Before this stage, the child cannot always start the flow at will but must wait until attention is taken by other things, when the perineal muscles will automatically relax and reflex voiding will occur. This incomplete voluntary control is clearly seen when a child is taken to the toilet, does not void, goes back to play, and immediately wets.

5. Voluntarily starting the stream from a full bladder requires combined pushing down of the thoracic diaphragm and tightening of the abdominal muscles. Once a child acquires this ability (usually soon after four years of age), he or she will invariably be able to void within seconds of sitting on the toilet, after resisting the urge to void long enough to get to the toilet. By this stage most children can also stop the urinary stream at will, and the bladder capacity is double what it was at the age of two years. As a result of these two new skills the occasional wet pants, which

most toilet trained toddlers experience, no longer occur, and most children can control their urine during the night.

6. By six years of age most children have learned to voluntarily start the urinary stream from a less than full bladder. To do this they must co-ordinate the relaxation of the perineal muscles with the use of the thoracic diaphragm and abdominal muscles. This new skill allows children to go to the toilet at almost any time and void, no matter how small an amount has accumulated in the bladder. By this stage children have again almost doubled their bladder capacity so that they should have no trouble holding urine during sleep. This is aided by the universal practice of inhibiting voiding for longer periods so that other activities are not interrupted (see Table 3.1).

It is likely that many retarded people who do learn to toilet themselves, with or without operant training programs, have acquired most of the voluntary controls over bladder and bowel functions, without the aid of special training, in the same way that most non-retarded people do.

3.3. THE NATURE OF TOILETING

The development of continence has been regarded by a number of authors as a largely spontaneous process resulting from maturation (McGraw, 1940; Muellner, 1960a, 1960b) which is only minimally influenced by the type of training received during early childhood (Klackenberg, 1955). However, when we consider the set of skills which must be acquired, it becomes apparent that a considerable amount of learning is involved. Moreover, the number of persons who fail to achieve complete mastery in the absence of organic pathology suggests that acquisition is a complex process. This complexity becomes apparent when the skills involved are analysed.

The skills involved in bladder and bowel control have already been described. However, continence involves a number of additional skills. The individual must be able to locate and approach the toilet, manipulate clothing, direct voiding into the toilet, and recognize when voiding has finished. These skills, together with those involved in bladder and bowel control, make up the complex behaviour known as toileting.

Mastery of toileting requires the acquisition of a number of fine discriminations and responses which must be performed in a fixed sequence of chain. This sequence is represented in Figure 3.1 as an operant chain of responses linked by discriminative stimuli which also act as reinforcers for the responses preceding them. However, this conception of toileting is complicated by the fact that some elements in the sequence are not readily observable. For example, contraction and relaxation of the perineal muscles to inhibit or bring about voiding cannot be observed, although they can sometimes be inferred from the presence or absence of voiding. In addition, discrimination of bladder or bowel pressure cannot be detected except indirectly through verbal reports. A further complication arises from the reflexive nature of uncontrolled voiding. The process of bringing voiding under voluntary control inserts a number of voluntary responses between the initial eliciting stimuli of bladder or bowel distention and the reflex voiding response. It also imposes environmental control over the reflexes themselves so that they can be delayed or induced at will (Muellner, 1960a, 1960b). Because of the initial reflexive nature of voiding it is possible that classical conditioning is at least partly involved in the development of bladder and bowel control.

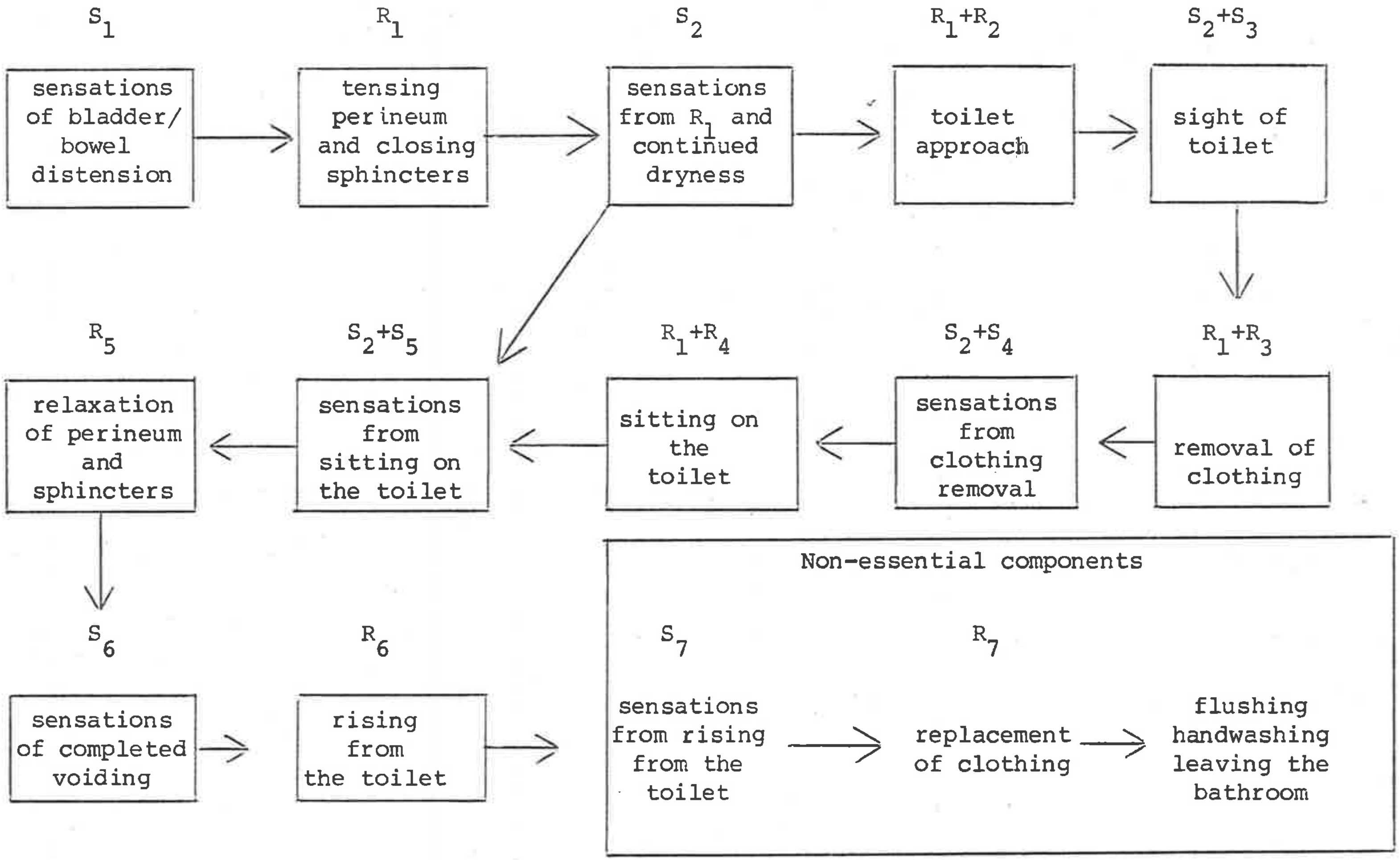


FIGURE 3.1. Schematic representation of the components of toileting.

A thorough analysis of the processes involved in the acquisition of toileting skills is yet to be done. In the meantime behavioural approaches to toilet training have been primarily based on an operant model. These will be reviewed in the following sections.

3.4. OPERANT TECHNIQUES IN TOILET TRAINING

Since 1960 there have been over 80 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 non-handicapped 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 soiling 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.

3.4.1. Toileting as a unitary response

Three case studies report successful applications of positive reinforcement to induce toilet defecations in three-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 distention, 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) adds some validity to the suggestion that reinforcement was one factor controlling defecation in these studies. A reversal condition was accidentally 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 distention. 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 were well 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 distention.

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 softeners 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 first to 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 and Van Handel (1970) treated a similar case with counselling in combination with aversive conditions 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, Nikoomanesh & Schuster, 1974; Kohlenberg, 1973). Engel et al. (1974) treated six adults and a six-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 thirteen-year-old boy who had previously been unsuccessfully surgically treated for Hirschprungs 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 distention 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 practice 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 distention 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 of 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 over the physiological processes involved in bowel functioning.

Nine papers have 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 3.1), between the sensations of bowel distention and the act of voiding (Chopra, 1973; Edelman, 1971; Houle, 1974; Keehn, 1965; Marshall, 1966; McDonagh, 1971; Pedrini & Pedrini, 1971; Scott, 1977; Wolf, 1965). All children were continent of urine.

Keehn (1965) and Pedrini and 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 and 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 long-term success. If we assume that acquisition in retarded children takes longer than in non-handicapped 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 hyper-active 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 24 weeks to reduce the 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 for 20 weeks with a gradual stretching of the reinforcement schedule. By the thirteenth week, soiling had completely stopped and only three soilings occurred during a four month follow-up 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 did not stop reacting angrily and depriving the subject of outings when soiling occurred, and their co-operation 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 and Meyer (1965) and Logan and 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 and Griffin (1969) only rewarded toilet defecation and did not achieve the immediate reduction in soiling found in other studies using this 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 fullness, 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 and also avoid the problems reported by Gelber and Meyer (1965).

3.4.2. 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 with the retarded whose procedures cannot be analysed because they do not provide enough information. 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 improvement were 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 percent 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 to assess whether this was so. Waye and 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 70 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 non-handicapped infants by Brown and Brown (1974), Madsen (1965) and Pumroy and Pumroy (1965). Pumroy and Pumroy studied their own two-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 non-handicapped children at around two years of age as a self learned skill. The 19-month-old in Madsen's study (1965) only took 12 days, under apparently similar training conditions, to achieve similar proficiency. However, this success was reported by Madsen on the basis of the parents' subjective reports with no supporting quantitative evidence.

Brown and Brown (1974) established behaviour control with their 17-month-old child much more rapidly than Pumroy and 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 16 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. They 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 distention. 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 and McGoldrick (1976) added rewards for dry pants and a gradual stretching of the toileting schedule. Completely accident-free 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 percent of the time and the child began to toilet himself independently. Wolf, Risley, Johnston, Harris and 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 institutionalized 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 distention. 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 reliably be 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 have 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, Bugle & O'Brien, 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, Bugle & O'Brien, 1971; Van Wagenen, Meyerson, Kerr & Mahoney, 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 by 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 self-initiated 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 self-initiating 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 1 to 14 days, and accidents after training reduced to zero within $1\frac{1}{2}$ to 5 months (Azrin & Foxx, 1971). Normal toddlers took $\frac{1}{2}$ to 14 hours to become self-toileting and maintained accident free performance during a four month follow-up period (Foxx & Azrin, 1973a).

A number of studies have modified the Azrin and Foxx procedures for the retarded. 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 and Ollendick (1977). They also found that the over-correction procedure for some children was emotionally disruptive.

Sadler and 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, Van Wagenen & Meyerson, 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 urine-activated 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 14-18 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 seven-year-old. The pants alarm 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 final 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 and Madsen (1969) reported the results for 70 non-handicapped children between one and three years of age. One group of children were toileted at predetermined times. They were shaped to sit on the pot and rewarded for using it. A second group wore pants alarms, without remote activation, and were taken to the pot whenever it sounded. No rewards or shapings 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 distention, methods for inducing inhibition of reflex voiding, the order of establishing component skills, and the methods of training the non-voiding skills. Smith (1979) and Wright (1975) both isolated two of these aspects for evaluation.

In Smith's (1979) 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 alarms. 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 procecures. 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 reward 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 Wagenen 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 as 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 had a clearly 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 of 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.

3.5. 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 have 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 non-handicapped 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, 1973a, 1973b). 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 immediately delivery of consequences during toilet training. These include pants and toilet or potty alarms (Azrin, Bugle & O'Brien, 1971; Cheney, 1973; Corey & Dorry, 1973; 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, Maurer & Watson, 1971; Marshall, 1966; Passman, 1975; Watson, 1968), and a buzzer system to signal self-initiated entry into the toilet (Hamilton, 1971).

A number of practical problems have been noted. At least one author has reported failure to achieve independence by some trainees even with the use of complex procedures, skilled trainers and relatively controlled conditions (Smith, 1979). 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, 1965; 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, 1973b). 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 (J.M. 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.

CHAPTER 4.

CONTINGENT CONSEQUENCES, GUIDANCE AND METHODS FOR INCREASING BEHAVIOURAL CONTROL DURING ACQUISITION

4.1. INTRODUCTION

The discussion in Chapter 3 of the accumulated reports of toilet training using behavioural procedures indicated that self-control of bladder and bowel function involves the acquisition of a number of skills. The major training strategies which have been used in the more complex programmes generally fall into three main groups. The first consists of contingent consequences for voiding. This is one set of procedures common to all behavioural toilet training programmes. The second was introduced by Giles and Wolf (1966) and consists of various procedures for gradually increasing skill in responses such as toilet approach, sitting on the toilet, and pulling pants up and down. These are the skills which do not directly involve bladder and bowel control, but which need to be acquired if the target of training is independent toileting. The third group of training strategies consists of devices designed to assist in the detecting of voiding so that the delivery of consequences can occur immediately. A key feature in toilet training is that the trainer be able to respond to voiding (Van Wagenen & Murdock, 1966). Difficulty in detecting voiding has been postulated to be one factor which may reduce the effectiveness of toilet training (Azrin et al., 1971; Cheney, 1973; Watson, 1968).

In this chapter, evidence relating to these three training strategies will be discussed. Toileting has been only one of many responses to which these strategies have been applied, but coverage of the non-toilet training literature will necessarily be selective since the literature is vast. The aim will rather be to place the application of such strategies to toileting within the wider context of behavioural research in general and research with retarded behaviour in particular. An experimental study of the relative contributions of the three training strategies to the acquisition of self-toileting will be described in Chapter 6.

4.2. CONSEQUENCES AND RETARDED BEHAVIOUR

Consequences which are contingent on a clearly defined response can come to control that response. Some consequences are reinforcing and serve to strengthen a response while others are punishing and serve to weaken the response. Behavioural control of this kind has been widely demonstrated experimentally with a range of responses in a range of animal species and human subjects (Skinner, 1938, 1953; Bandura, 1969). Furthermore, the control which contingent consequences can exert over behaviour is often highly sensitive to variations in environmental conditions such as the relationship of other stimuli to the consequence, the schedule under which the consequences are delivered, the nature of the consequence, and the availability of other responses in the situation.

Responses which can be controlled by their consequences in this way are termed operant or instrumental responses. Laboratory research has generally been concerned with specifying the exact operation of environmental conditions in behavioural control and thereby developing general principles. Therefore, the operant responses which have been studied have generally been chosen because they "are easy to emit, observe, record, and integrate with stimulus operations" (Bijou & Baer, 1966, p. 733). They include such simple responses as bar pressing, key pecking, button pushing and ball dropping.

Applied studies, on the other hand, have been concerned with extending the principles of behavioural control developed in the laboratory to socially significant or intrinsically interesting human behaviour. A practical concern to increase the adaptive functioning of individuals or eliminate behaviour problems has often been behind such studies. This is in contrast to the primarily empirical concerns of most laboratory research. However, where socially significant responses are the subject of study, compromises in experimental control are usually necessary. For instance, response definition, observation and recording become more difficult, elimination of all factors other than those which are experimentally manipulated is often impossible or unethical, and controlling the contingencies which are being applied requires considerable ingenuity. In addition, the responses themselves are often already strongly controlled and this alone can interfere with any demonstration of control by experimentally introduced contingencies. Nevertheless, the acquisition, control, maintenance and weakening of a wide range of significant human responses have been demonstrated (Bandura, 1969; Bijou & Baer, 1966).

Investigation of the operation of consequences on retarded behaviour has interested researchers for both empirical and practical reasons. Until early this century the behavioural deficiencies of the retarded were thought to be inherent and largely unmodifiable (Tizard, 1974). Thus, an early emphasis of operant research with retarded persons was to discover whether the manipulation of consequences could lead to behavioural change in them as it did in various animal species and non-retarded persons. Clearly change was possible, as attested to by a number of experimental studies (Spradlin & Girardeau, 1966; Weisberg, 1971), thus allowing Clarke and Clarke to assert in 1974; "At least one conclusion emerges with absolute clarity from twenty years of experimental work; any human being, of whatever level, is capable of at least some learning" (p. 8). As early as 1949, Fuller demonstrated operant strengthening and extinction of a well-differentiated arm movement in a "vegetative idiot" in just four experimental sessions, despite the belief among the physicians at the institution that no learning was possible. Training sessions with the 18 year-old boy were mostly carried out before breakfast so that he was without food or drink for up to 15 hours prior to training. A squirt of sugar-milk solution was delivered into his mouth for every appropriate arm movement. By the last training session the rate of responding reached three a minute, which represented practically the highest rate possible, considering the time taken to receive and swallow the milk.

Since that time the ability of environmental consequences to control many responses has been demonstrated in a range of retarded persons. One example is the study by Ellis and Distefano (1959). They gave two matched groups of retarded individuals, with a mean IQ of about 52, a pursuit rotor task. One group was continually praised for performance during trials while the control group was merely instructed beforehand to make as high a score as possible. Both groups were told their scores at the end of each trial. Performance improved for both groups, but it improved significantly more under reinforcement conditions. Bailey and Meyerson (1969) also demonstrated operant control in a seven year-old profoundly retarded, blind and at least partially deaf child. Continuous reinforcement with a vibratory stimulus strengthened lever pressing and maintained it over a three week period. Moreover, the extinction curve following conditioning was similar to those traditionally obtained in operant research.

Once the possibility of operant control of retarded behaviour had been demonstrated, laboratory research very quickly moved to examining the factors involved in the acquisition and maintenance of behaviour. However, the issue of simple consequential control has remained important in applied research. This is because the behaviour itself has often been the central focus, and the issue has been generality of control over a range of socially significant responses rather than an examination of the factors involved which occur in the natural environment. The practical incentive for such research has been to increase the adaptive functioning of retarded individuals or to eliminate problem behaviour which interferes with adaptive functioning. As with toilet training, most applied studies have manipulated positive rather than aversive consequences in order to accelerate behaviour (Gardner, 1971; Kiernan, 1974).

However, sometimes performance of the response being trained has been hampered by the existence of inappropriate or maladaptive responses. Often such incompatible responses have been extinguished in the absence of specific reinforcement and as the appropriate responses were strengthened. Generally, this has been the approach of most behavioural programs with retarded persons (Kiernan, 1974). However, occasionally competing responses have not been successfully eliminated by this method (Weisberg, 1971). For instance, positive reinforcement for appropriate behaviour, together with extinction of the incompatible responses of screaming (Hamilton & Standahl, 1969), dangerous climbing (Risley, 1968), non-compliance in a preschool setting (Baer, Rowbury & Baer, 1973), or problem behaviour in the classroom (Birnbrauer, Bijou, Wolf & Kidder, 1965) had at best only partial success. Consequently, these authors and others have used contingent punishment to eliminate competing responses during training of appropriate behaviour (Kiernan, 1974; W.I. Gardner, 1969).

Evidence suggests that suppression of a punished response is greatest when punishment is used in conjunction with positive reinforcement for alternative behaviour (Azrin & Holz, 1966; Herman & Azrin, 1964; W.I. Gardner, 1969). Furthermore, punishing competing responses can enhance acquisition of positively reinforced desired behaviour (W.I. Gardner, 1969). Punishment procedures which have been used to reduce unwanted responses in retarded persons include events such as time out from positive reinforcement, isolation, shock, physical restraint, withdrawal of positive reinforcers, conditioned aversive stimuli such as "no" (W.I. Gardner, 1969), and overcorrection (Murphy, 1978). The growing concern with treatment ethics has led more recent research to discover less restrictive and more socially acceptable punishers. As a result, the range of effective punishers has widened to include such events as a watermist applied to the face (Dorsey, Iwata, Ong & McSween, 1980), interrupted music (Barmann, Croyle-Barmann & McLain, 1980) and contingent exercise (Luce, Delquadri & Hall, 1980).

Punishment in conjunction with positive reinforcement for alternative behaviour has been used successfully during the training of speech (McReynolds, 1969), to reduce self-destructive or aggressive behaviour and strengthen alternative appropriate behaviour (Peterson & Peterson, 1968; Vukelich & Hake, 1971) and to suppress incorrect and strengthen correct button pressing (Birnbrauer, 1968).

Behavioural consequences have two essential aspects. One involves the nature of the discrete stimulus events being presented and the other involves the temporal relationship or contingency between the stimulus event and the behaviour. The issue of events which can act effectively as reinforcers or punishers has been an important focus of research for many years (Azrin & Holz, 1966; Dunham, 1977; Glasser, 1971; Tapp, 1969), particularly in relation to human behaviour over which the experimenter has less control than in animal studies (Bijou & Sturges, 1959; J.M. Gardner, 1969; Spradlin & Girardeau, 1966; Weisberg, 1971). The temporal relationship between consequence and behaviour is also important, although this aspect has received little attention (Harzem, 1975; Morse & Kelleher, 1977).

4.2.1. Contingency and Consequences

Following Skinner's original analysis of operant behaviour (Skinner, 1938) it has been widely accepted that if consequences are to influence behaviour they must follow closely after every emission of the particular response (continuous consequences) or at least follow a number of emissions in a systematic pattern (intermittent schedules of consequences). This systematic temporal relationship between response and consequence is central to operant theory and methodology. The correlation of consequence with response is termed contingency and this has been shown to be as relevant to the control of significant human behaviour as it is for the control of animal behaviour in laboratory conditions, e.g. Hart, Reynolds, Baer, Brawley and Harris's (1968) control of cooperative play in a five year old child.

However, response-reinforcer contingencies have not always proved to be essential factors in either the acquisition or maintenance of operant behaviour. For instance, Brown and Jenkins (1968) placed food-deprived, magazine-trained, naive pigeons in a dimly lit chamber containing a key which could be illuminated. The key was illuminated every 60 seconds on average, and each illumination was followed by the delivery of food. Thus, food delivery was non-contingent. Nevertheless, all 36 pigeons began pecking at the illuminated key after between 6-119 food pairings. This procedure whereby acquisition of a response occurs under non-contingent reinforcement has been termed autoshaping.

It appears, from this and a number of later studies, that key pecking in pigeons which responds to various arrangements of contingent consequences in the same way as any other operant can also be generated by stimulus-stimulus contingencies; that is, when an unconditioned stimulus (in this case, illumination of the key) predicts the likely occurrence of food, it can come to elicit the response of key pecking (Gamzu & Williams, 1973). It has been suggested that Pavlovian control is the possible mechanism involved in autoshaping. This occurs because pecking in the pigeon is not only an operant but also a major component of the consummatory feeding response which is largely instinctive in nature and unconditionally elicited by food. However, autoshaping of non-consummatory responses has also been demonstrated (Gamzu & Schwam, 1974; Sidman & Fletcher, 1968; Wasserman, 1973). In addition, non-contingent reinforcement has been shown to maintain a number of responses for a considerable period of time (Schwartz & Gamzu, 1977; Schwartz & Williams, 1972). The process in both autoshaping and automaintenance appears to be the result of a contingency between the two stimuli involved rather than a response-reinforcer contingency (Rescorla, 1968, 1969).

Contingency has also been assumed to be essential in the operation of punishment to reduce behaviour. However, the experimental study of punishment has been avoided by many researchers for humanitarian reasons (Solomon, 1972), and unwillingness to impose inescapable punishment in non-contingent situations has no doubt compounded the general failure to consider contingency as a factor requiring investigation. The few studies of contingency and punishment which do exist are not conclusive. Some investigators have found that non-contingent punishment had little effect on the responses studied (Annau & Kamin, 1961; Azrin, 1956; Myer, 1968), while in other studies all behaviour, including the response under investigation, has been suppressed by non-contingent punishment (Hunt & Brady, 1955). Furthermore, response-independent shock appears to actually facilitate rather than reduce responding in some circumstances, depending on the organism's past history with shock (Morse & Kelleher, 1977).

To this author's knowledge, the effects of non-contingent punishment on human behaviour have not been studied. This is understandable, considering that punishment for no reason is generally regarded as unethical, if not sadistic. Moreover, no animal or human studies of contingency exist in which punishment is used to reduce one behaviour in conjunction with reinforcement for an alternative response. Consequently, the remaining discussion will be concerned only with the contingency of positive reinforcement.

The effects of contingency become more difficult to investigate in relation to significant human behaviour which is highly complex in comparison with key pecks and bar presses. Moreover, unlike laboratory animals, human subjects come to experimental situations with an extensive reinforcement history and an unknown amount of experience with the behaviour in question. There is no way of assessing what effect this prior history may have on the experimental manipulations under study. The value and strength of the reinforcers used are also less readily controlled in human research, since deprivation is usually considered unethical, or at least inadvisable, and effective reinforcers are often idiosyncratic. Furthermore, because much human research involves both planned and unplanned interactions between subjects and others, unrecognized contingencies may also be operating on the behaviour of interest (Bijou & Baer, 1966). Nevertheless, a number of investigators have studied the effects of contingency on the acquisition and maintenance of human behaviour.

Vocalization in three-month-old infants responded predictably to the contingency of social reinforcement in a study by Weisberg (1963). Contingent social reinforcement was the only condition which resulted in an increased rate of vocalization. Neither social reinforcement which was non-contingent nor a door chime presented both contingently and non-contingently acted on the behaviour in any perceptible way. It is possible that infant vocalization is not susceptible to the control of reinforcers unless they are 'functionally relevant'. Chimes have proved to be effective reinforcers for other behaviour in slightly older infants (Rheingold, Stanley & Cooley, 1962; Simmons & Lipsitt, 1961). However, vocalization in the early months of life appears to be spontaneous, species specific behaviour which may be subject to biological constraints in much the same way as instinctive consummatory animal behaviour. It has been postulated that such behaviour may be predisposed to only response-reinforcer combinations which have some functional relationship (Dunham, 1977).

The more arbitrary response of wheel turning was chosen for study by Bandura and Perloff (1967). Delivery of rewards occurred at the beginning of each session in the non-contingent condition. They found that contingent reinforcement maintained a significantly higher rate of performance to standard than the non-contingent condition, which in turn resulted in the same level of performance as no reinforcement. However, both the latter groups maintained responding, though at a lower rate than when reinforcement was contingent. Therefore, the non-contingent condition was probably not responsible in itself for response maintenance. In fact, the apparatus used in this study delivered a certain amount of contingent reinforcement to all children over and above that manipulated by the experimenters.

So far, then, there is no evidence that non-contingent reinforcement has any effect on human behaviour. A more complex response was chosen by Brigham, Finfrock, Breunig and Bushell (1972). They used progress through programmed hand writing material, as measured by the number of exercises completed correctly. Reinforcement consisted of tokens which were exchanged at the end of each session for any of a selection of activities or cookies. The subjects were six 5-year-old kindergarten children divided into two groups. A baseline was established for nine sessions, during which time the teacher attended to and praised correct work. Then group A received tokens contingent on every fourth or fifth correct exercise, while group B received 10 tokens at the beginning of each session (the non-contingent condition). Following that, the contingencies were reversed so that group A now received non-contingent tokens and group B received contingent tokens. These conditions were reversed again, and finally both groups received contingent tokens.

During each contingent condition, accuracy was raised above the baseline rate, while non-contingency lowered it to below baseline. This latter finding is important, since it shows that non-contingency was not neutral, but had a depressing effect on accuracy. At the same time the rate of performance, irrespective of accuracy, increased markedly when group A transferred from contingent to non-contingent tokens. This was not originally the target of contingent reinforcement, nor could it have been under adventitious reinforcement during non-contingency, since the tokens were delivered at the beginning of the session.

Several factors may have been operating to produce the effects seen under non-contingency. This was not a controlled environment, unlike those used by Weisberg (1963) and Bandura and Perloff (1967). The two groups of children were seated together around the teacher in their normal classroom and could see the other children working, being praised and receiving tokens. Interaction between the children was uncontrolled. Moreover, the teacher's praise varied according to whether tokens were being delivered, although she had been instructed to maintain the same quality and frequency of praise with all children. These uncontrolled factors may have introduced a number of unknown influences which could have accounted for the non-neutral effects of non-contingency.

A similar study with emotionally disturbed boys examined the effects of contingent and non-contingent tokens on performance on a programmed mathematics course (Rickard, Clements & Willis, 1970). Five boys worked under baseline, contingent, non-contingent and contingent reinforcement conditions in that order. In this study, non-contingency meant a number of tokens based on earnings during the contingent phase and delivered at the end of each session. Non-contingency reduced performance to below baseline level as it did in the Brigham et al. study, while the first period of contingent reinforcement raised it well above baseline. However, the gains in correct performance made during the first contingency phase were not matched during the second, which did not even exceed baseline. Non-contingency again appeared to have anything but a neutral effect. However, whether the reduced gains during the second contingent reinforcement phase was due to the influence of the prior non-contingency phase cannot be deduced from the data.

A study by Perry and Garrow (1975) throws some light on this question. They were particularly interested in the social deprivation-satiation effect proposed by Gewirtz and Baer (1958), who postulated that "children subject to a social deprivation treatment in which they receive a low frequency of social reinforcement subsequently make a greater number of 'correct' responses on a discrimination learning task than children given a satiation treatment in which they receive social reinforcement in high frequency" (Perry & Garrow, 1975, p. 681).

Six groups of primary school children were first presented with a picture similarities task, during which each group received a different arrangement of reinforcement. The six conditions consisted of approval contingent on performance, contingent on the experimenter's behaviour and non-contingent (at a time when the subject was not interacting with the pictures). Each of these three conditions applied at either a low or a high frequency (2 or 16 instances a session). After the completion of 20 trials, a discrimination task using similar materials was presented, during which all children were reinforced for every correct choice.

The contingency during the earlier task had a marked effect on performance on the later task. All children improved, no matter what the earlier contingency had been, but those who had experienced non-contingent reinforcement improved significantly less than those who had experienced contingent reinforcement, with the non-contingency based on the experimenter's behaviour leading to improvement which was intermediate between the other two conditions. This pattern obtained at both reinforcer frequencies, but was only significant following the higher frequency. Most children perceived the experimenter-contingency as contingent on their own behaviour, so this condition cannot be considered as truly non-contingent.

These results suggest that experience with a reinforcer which is non-contingent can reduce acquisition when the same reinforcer is later applied contingently. It was suggested by Perry and Garrow that the deprivation-satiation effect only occurs when the reinforcer has not been clearly contingent on performance. These results are similar to those in the study by Rickard et al. (1970) and were confirmed in a later study by Babad and Weisz (1977).

A similar experiment by Barton and Ascione (1978) failed to fully replicate the Perry and Garrow findings. However, this may be explained by their subjects' failure to learn the discrimination task, as shown by a non-significant difference between consecutive blocks of trials. It may be that prior contingencies affect acquisition differently from static behavioural output.

Waters (1980) also used a number of exercises completed during a programmed study course as the dependent variable in one of a series of studies of social reinforcement. The task in experiment 4 was a programmed introductory statistics course and the subjects were 24 first-year female psychology students who had failed a statistics unit during the year. Reinforcement consisted of approving comments. One group received approval each time a page was turned indicating completion of one or more exercises (contingent reinforcement). The second group was yoked to the first and received reinforcement at the same relative time (non-contingent reinforcement). This probably provided unsystematic intermittent reinforcement for page turning, so that a contingency of sorts may have applied. Two further groups acted as controls, with the experimenter either present or absent.

The number of exercises completed and improvement on a test given before and after the study were both significantly better under contingent reinforcement than under non-contingent reinforcement. Nevertheless, under non-contingent and no reinforcement, students performed nearly as well, indicating that factors other than approval or its contingency may also have been operative to maintain behaviour. Such factors may have included intrinsic motivation, the requirement that students act as subjects in experiments as part of their course work, and the desire to obtain a pass mark at the end of the year. For these reasons conclusions cannot be drawn about the relative effects of either non-contingency or no reinforcement.

Ayllon and Azrin (1965) investigated whether the behaviour of psychotics could be controlled by reinforcement. They demonstrated several methods of removing response-reinforcer contingency. Subjects were institutionalized, long-stay psychiatric patients, and the behaviour of interest was selection and performance of work assignments. Reinforcement consisted of tokens which could be exchanged for a range of activities or goods previously shown to be frequently sought by patients. All experiments followed an ABA experimental design with the contingent condition designated as A.

Four methods were used in the B condition to discontinue the particular response-reinforcer contingency. One consisted of withdrawing the reinforcer from the particular job which the subject had chosen and making it contingent on a non-preferred job. A second was the same, except that the A condition assigned a large number of tokens to the preferred job and only a small number to the non-preferred jobs. Removal of contingency consisted of reversing the large and small token numbers. A third method consisted of giving the same number of tokens earned during the contingent condition at the beginning of the day. This is similar to the definition of non-contingency by Bandura and Perloff (1967) and Brigham et al. (1972). The fourth method consisted of no reinforcement.

In nearly all cases contingent tokens results in an immediate increase in the particular behaviour and its continued maintenance while the contingency was in effect. With the first two methods of discontinuing the original contingency there was an immediate and abrupt cessation of performance on the particular job because patients transferred to the newly reinforced jobs. However, in the non-contingent and no reinforcement conditions there was an initial tailing off before work ceased.

Interpretation of these results must be made carefully because instructions to patients also varied systematically between the B conditions, and the responses may have been at least partially determined by them. In the first two B conditions the instructions 'set' the patients to think only in terms of one job or another. In the non-contingent condition they were told that they would receive tokens whether or not they worked: "In a sense, you will be getting a vacation with pay" (p. 366). In the no reinforcement condition patients were told "Now, it is up to you if you want to continue working. We won't have any tokens to give you for it". (p. 376).

Many studies of human behaviour use instructions to elicit the required behaviour and alert subjects to the experimental conditions. Bijou and Baer (1966) discussed the significant contribution which instructions can make to differences in performance and commented on the need to actively investigate instructional control. When investigating contingency, the influence of instructions is yet another factor which should be controlled.

It would appear from most of these studies that contingency is a necessary factor in the acquisition and maintenance of a range of voluntary human responses. However, a variety of conditions were classified as non-contingent. Weisberg (1963) delivered a pre-determined number of reinforcers at a pre-determined rate during the non-contingent condition, but did not indicate how the number and rate compared with those experienced during contingent delivery. This introduced a systematic difference in the two conditions which was not contingency per se. In order to ascertain whether contingency was the operative factor, the same number of reinforcers would need to be delivered in each condition.

Perry and Garrow (1975) and Barton and Ascione (1977) achieved this by delivering the same pre-determined number of reinforcers on the same trials in each condition, thus establishing an undefined intermittent schedule in the contingent condition, while no response-reinforcer pairings occurred in the non-contingent condition. This procedure was acceptable, since it was the acquisition of behaviour during subsequent training which was of interest rather than the behaviour emitted during the prior contingency conditions. However, when the direct action of contingency on behaviour is at issue the number of likely contingent reinforcers are determined by the frequency with which the particular behaviour occurs and cannot be set beforehand.

Some investigators, interested in acquisition under the direct effect of reinforcers, have presented a pre-determined number of reinforcers at the beginning of each session (Ayllon & Azrin, 1965; Bandura & Perloff, 1967, Brigham et al., 1972) or at the end of each session (Rickard et al., 1970). This method fails to control the timing and spacing of reinforcers, thus introducing another unwanted systematic variation. However, given an appropriate research design, it does allow matching of the number of reinforcers in the two conditions (Rickard et al., 1970).

The yoking procedure for defining non-contingency used by Waters (1980) comes closest to controlling these extraneous factors. It is similar to the random control procedure used in many autoshaping studies. Nevertheless, it leaves one further problem unsolved. Truly random delivery allows some chance pairings of response-reinforcer which may come close to being an intermittent schedule of contingent reinforcement rather than non-contingent reinforcement. There is some evidence for this occurring in animal studies of adventitious reinforcement and 'superstitious' behaviour. When food is delivered without reference to the behaviour occurring at the time, one or more responses may be 'trapped' and strengthened through chance pairings (Skinner, 1948; Morse & Skinner, 1957; Neuringer, 1970). Neuringer suggested that many learned responses may be maintained by events outside the organism's range of control; that is, by accidental response-reinforcer pairings. A contingency of sorts exists, albeit undefined.

4.2.2. Contingency and reinforcement with the retarded

Retarded persons, and especially those who are severely or profoundly retarded, present special problems to behavioural researchers. The range of activities, edibles and other stimuli which are effective with non-retarded children and adults are often not effective with retarded persons. Many do not respond to social reinforcement, money or tokens. Stimuli which are reinforcing are often idiosyncratic to particular individuals or do not maintain their reinforcing characteristics over a period of time (Spradlin & Girardeau, 1966). Consequently much reinforcement research with the retarded has focussed on those stimuli which will control particular responses (Spradlin & Girardeau, 1966; Weisberg, 1971). Demonstrations of effectiveness have generally involved comparisons with unreinforced control groups or alternations of conditioning and extinction conditions. Nevertheless, several studies have manipulated contingency.

Hall and Broden (1967) were interested in the effect of contingent reinforcement on low probability behaviour. They studied three developmentally delayed brain-injured children with the aim of strengthening developmentally adaptive behaviour rarely displayed by the children. The target behaviour in one case was manipulative eye-hand motor tasks such as drawing, colouring, pasting and working puzzles. In a second case it was climbing on pre-school climbing apparatus and, in the third, parallel and co-operative play with other children.

In each case the experimental design consisted of baseline, contingent reinforcement, a reversal procedure consisting of reinforcement contingent on any behaviour other than the target, followed by a return to target-contingent reinforcement. The reversal approximated the non-contingency procedure recommended in Section 4.2.1., except that the number of deliveries was not matched. It did, however, avoid chance response-reinforcer pairings which could maintain behaviour on an intermittent schedule. In all three cases the frequency of the target behaviour rapidly increased during contingent reinforcement and returned to the baseline level during non-contingent reinforcement.

Redd and Birnbrauer (1969) were interested in whether adults who make their reinforcement contingent on a child's behaviour are more likely to become discriminative stimuli for the previously reinforced responses than adults who reinforce non-contingently. The target behaviour was manipulative and co-operative play in two severely retarded children who rarely played. The study was carried out in the presence of four other similar children. Edible reinforcers were delivered by Adult I contingent on play on an FI schedule of 45 seconds with a limited hold of 15 seconds. In the non-contingent condition reinforcers were delivered once every 60 seconds by Adult II without regard to the child's behaviour, the number delivered matching the number delivered contingently. The order in which the two conditions occurred was varied to avoid systematic sequence effects, with a return to baseline following each condition. In addition, the contingency was reversed during some sessions so that Adult I delivered non-contingent and Adult II contingent reinforcement.

During the study play came to be emitted only in the presence of contingent reinforcement, and in later non-reinforced tests it again occurred only in the presence of the adult who had previously delivered contingent reinforcements. However, the contingent adult only acted as a discriminative stimulus for play when holding the reinforcer cup.

The results from these two studies seem to accord with the findings for low-probability responses in non-handicapped persons. However, two studies of well-established, high probability responses do not. The first study demonstrated that free, response-independent reinforcement introduced during extinction of an experimentally established and stabilized response resulted in the reinstatement of that response (Spradlin, Fixsen & Girardeau, 1969).

Their subjects were 12 severely retarded children who performed a button-pushing task in an automated experimental room. The response was first established on an increasing ratio until it was being maintained with food reinforcement on FR-25. Once the response was stable, an extinction session was run, during which one of three events occurred following each 2-minute pause in responding. Either food was delivered, a novel 5-second buzzer was sounded, or no stimulus event was presented. These events were presented in varying order to counterbalance sequencing effects. The latter two conditions produced no change in the extinction curve. However, the delivery of free food reinforcement appeared to act as a discriminative stimulus eliciting the response which it had initially reinforced. These results confirm the study by Redd and Birnbrauer (1969).

Hollis (1973) suggested that "a reinforcer delivered independently of behaviour: (a) decelerates baseline response rates following a specified schedule (e.g., FR or VI); (b) accelerates baseline response rates for dominant "free-operant" behaviours and following experimental extinction; and (c) that a stimulus may acquire multiple functions with respect to a reinforcing event" (p. 596). He demonstrated this in an ingenious series of experiments with six institutionalised, severely retarded children in an automated experimental room. The dominant responses consisted of stereotyped hand wringing, head rolling and body rocking which occurred without apparent antecedent events or consequences.

The introduction of response-independent or non-contingent reinforcement in the form of food or drink resulted in a substantial increase in the stereotyped response over free-operant baseline levels and acceleration was even greater with more frequent delivery. Another less frequent response of ball manipulation was also recorded but was not affected by the non-contingent reinforcement. However, when both a high probability stereotyped response and low probability responses (leg extension and ball manipulation) were first conditioned on a VI or FR schedule, both decreased during non-contingent reinforcement to below baseline levels. Deceleration was not complete because the non-contingent condition maintained a level slightly above that obtained in extinction, and, when it followed extinction, led to some recovery in the response.

The non-contingent condition in these experiments provided some adventitious response-reinforcer pairings in the same way as the random control procedure used in autoshaping. However, stereotyped responses in retarded persons of the kind studied by Hollis cannot be regarded as components of consummatory behaviour in the accepted sense, although this has been a common explanation of the autoshaping phenomenon. Hollis's data suggest that an important aspect which may also predispose a response to ready strengthening and maintenance by non-contingent reinforcement may be its initial high probability of occurrence independent of reinforcement. Once control of such a response by contingent reinforcement is established, non-contingency appears to have the usual decelerating effect. These findings are supported by other studies (Reid, 1958; Spradlin, Girardeau & Hom, 1966). Nevertheless, even after such control has been established, a period of extinction can result in non-contingent reinforcement again having an accelerating effect. The report by Spradlin, Fixsen and Girardeau (1969) suggested that the reinforcer comes to operate as an eliciting or discriminatory stimulus in this last situation.

The responses discussed thus far have been unitary operants capable of being established and controlled by consequences alone. Few studies have manipulated contingency in relation to more complex behaviour without also introducing other eliciting procedures. Once other procedures are involved, the problem of isolating the effects of contingency alone become acute. Applied studies are frequently concerned to reverse behavioural deficits by establishing new behaviour. It is not usually practical to rely on reinforcement alone to establish new behaviour because it rarely or never occurs. Even shaping successive approximations is rarely used on its own to establish a new response, since it can involve few experiences of reinforcement for the individual while waiting for long periods of time for the successive behavioural variants (Kiernan, 1974). Instead, prompt and fade procedures, often using physical guidance, are used in conjunction with contingent reinforcement.

A study by Baer, Peterson and Sherman (1967) of imitation among retarded children illustrates this combination of procedures while also highlighting some of the problems involved in isolating contingency. They worked with three severely and profoundly retarded children who had previously shown no evidence of imitation, thereby providing an opportunity to investigate whether a totally new response could be induced.

Training sessions occurred at mealtimes with spoonfulls of food and the word "good" as the reinforcer. Shaping and physical guidance were used to elicit responses when these did not occur spontaneously and were systematically faded as training proceeded. A number of single responses were demonstrated by the model, beginning with those that the child could already perform. Each demonstration was accompanied by the words "Do this" as the discriminative stimulus. To establish whether imitation had been acquired a number of probe responses were demonstrated without reinforcement. Imitation was increased with this procedure from 0 percent at the beginning of the program to 80-100 percent. For two children this required the demonstration of 130 new responses.

Once imitation had been established, reinforcement was made non-contingent. In this condition food and "Good" were still delivered at regular intervals during the session. Intervals between deliveries consisted of 20, 30 and 60 seconds, and no reinforcer was delivered until at least 20 seconds after the last imitative response had occurred. Following this, the contingency was returned. Imitation of both the reinforced and unreinforced probe demonstrations that had previously increased with training decreased for two children in the non-contingent 20 and 30 seconds condition, then returned to the previous strength once the contingency was reinstated. One child maintained her rate of imitation during non-contingent 30 and 60 seconds delivery. However, imitation dropped to zero when non-contingent reinforcement occurred after the words "Do this" but before the imitative response could occur. Zero performance was then maintained, after a brief recovery when non-contingent reinforcement every 30 seconds was reinstated.

The effect of non-contingency is unclear in this study for several reasons. The prompting and guidance procedures were also deleted and reintroduced along with the change in contingency for at least two of the children. It is therefore not possible to attribute the decrease and return of imitation in these two cases to the change in contingency alone. Moreover, the interpolation of non-contingent reinforcement immediately after the command in the third case actively forestalled any response rather than simply making reinforcement non-contingent.

Lovaas, Berberich, Perloff and Schaeffer (1966) similarly demonstrated the establishment and strengthening of imitative speech in two mute schizo-prhenic children using a food reward. They also introduced a period of non-contingency, during which the verbal model was presented, but rewards were delivered contingent upon time elapsed since the last reward, regardless of the child's behaviour. Non-contingency in this case presumably allowed some chance response-reinforcer pairings as in the random control procedure. These authors also reported a reduction in imitative responses under non-contingency, although no data were presented. However, shaping and prompts were used in conjunction with contingent reinforcement during training and it is not possible to tell from the information provided whether these procedures were also systematically withdrawn and reinstated along with the contingency.

These two studies illustrate the difficulty of isolating the effects of contingency when several procedures are combined to strengthen a response. It is possible that the several procedures interact. For instance, in the two studies described above, shaping and physical guidance were required to mould the imitative response so that reinforcement could then be applied. Thus, the operation of contingent reinforcement was dependent on the success of these procedures as well as on the occurrence of the response. Moreover, no test was made of how the moulding procedures contributed to the behaviour changes which occurred.

4.2.3. Contingency and toileting

Demonstrating the effect of contingency on complex chains of responses such as toileting poses even more difficulties than those discussed above. Not only are a number of procedures required to elicit and build each of the component skills and join them together as a smoothly performed sequence, but the central responses of preventing and starting voiding are not readily observable. It has been assumed that the muscle control required in these responses is operant in nature and therefore susceptible to the control of contingent reinforcement.

Many reports of toilet training have ignored the total sequence of responses and concentrated on this muscle control. The majority of such reports have been of individual or group case studies in which contingency or any other training variables have not been experimentally varied, and no experimental controls have been used. However, three studies have attempted to vary contingency.

The earliest operant study of bladder and bowel control was reported by Blackwood (1963). He divided 45 institutionalized, severely and profoundly retarded children into three groups, matched for mean age, I.Q. and years spent in the institution. One group of 15 acted as a no reinforcement control and remained in their usual ward under custodial conditions. This ward contained 30 children in all, with a staff-child ratio of 1:20. The other two groups were transferred together into a ward in which the staff-child ratio was doubled to 1:10. The toilet voiding of one of these groups received contingent praise and food. The toileting of the other group was handled in the conventional institutional manner without programmed reinforcement.

However, the children in this condition probably received more general staff attention as a result of the higher staff ratio, although it was not programmed specifically in relation to toileting. Blackwood did not record interactions between staff and children, but suggested that its quality and quantity may have increased, not only because of more staff, but also because of the training that these staff received in reinforcement techniques. The same staff dealt with both experimental groups. Therefore, although staff were expressly instructed not to provide contingent reinforcement for toilet voiding to the increased attention group, it is likely that their responses were often made contingent on many appropriate responses emitted by the children.

The accident rate was reduced to the same degree in both the attention and contingent reinforcement groups, while remaining unchanged in the no reinforcement group. However, it is uncertain what led to these results. It may be that the two groups were taken to the toilet more frequently than the no reinforcement group because more staff were available. If that were the case, the improvement may reflect increased staff opportunity to catch more voidings in the toilet rather than an increase in the children's toilet voidings. However, Blackwood did not comment on this possibility. He attributed the similar improvement of the two groups to an increase in attention, irrespective of whether it was contingent or not, in line with suggestions that persons who provide contingent reinforcement to children themselves become discriminative stimuli signalling that required behaviour will be reinforced (Babad & Weisz, 1977; Hollis, 1973; Perry & Garrow, 1975; Redd & Birnbrauer, 1969; Spradlin, Fixsen & Girardeau, 1969).

Hundziak, Maurer and Watson (1971) carried out a similar study with institutionalized severely retarded children comparing the same three conditions. However, they ensured that both the conventional training and reinforcement groups were placed on the toilet at about two-hourly intervals. Reinforcement consisted of candy delivered through a dispenser beside the toilet, and toileting was the only target behaviour. Accident rate did not change significantly for any group. This leads one to suspect that Blackwood's improved accident rate did indeed reflect more frequent toileting of the children by the staff. The main measure in the Hundziak et al. study was frequency of toilet voiding. Under the more stringent controls imposed in this study, toilet voiding did improve significantly with contingent reinforcement. There was no similar improvement for the conventional training method despite the extra attention that subjects received.

These two studies dealt with urination and defecation together. One other study considered bowel control alone (Tomlinson, 1970). In this study a non-retarded three-year-old was treated for long standing bowel retention with occasional constipation. Bowel movements occurred only once every 7 to 10 days before training. During training, bubble gum, which was highly sought after by the child, was made contingent only on toilet defecations. In addition, a mild laxative was administered daily in the first week to prevent constipation. Non-contingency was introduced accidently during the 13th week of training when the child went to stay with grandparents who were unaware of the contingency and gave him bubble gum whenever he requested it. The frequency of defecations immediately returned to baseline, but recovered when the contingency was reinstated. The author suggested that this was directly due to the changes in contingency. However, it is possible that the change in environment also had some effect.

It does appear that the contingency of reinforcement is important in the acquisition of bladder and bowel control. However, these three studies are only suggestive for three reasons. Firstly, extraneous factors were not eliminated. The contribution of staff behaviour in the Blackwood study has already been mentioned. In addition, none of the studies controlled the behaviour of trainers during toileting, other than to specify the delivery of contingent reinforcement. Second, none of the studies precisely defined or controlled non-contingency. The third reason resides in the nature of toileting which consists of a complex chain of interrelated responses. In the Tomlinson study the child possessed the full chain except for the one response which was targeted; defecation in the toilet. The apparent importance of contingency in that case clearly reflected findings in relation to other low probability responses.

Suggestive as these studies are, they leave some important issues unresolved. Contingency appears to be a necessary factor in the strengthening of the unitary responses discussed so far. However, very young children and many retarded persons have little or no skill in many of the responses involved in the toileting sequence. This was the case in the Blackwood (1963) and Hundziak et al. (1971) studies. In such cases, were rigorous experimental controls to be instituted, it is doubtful whether selecting only one element to be strengthened would be effective, since the responses in the toileting sequence are interdependent. For example, in order to inhibit voiding accidents, the individual needs to recognize bladder or bowel tension, be able to find a toilet, deal with clothing, sit and bring about the onset of voiding once on the toilet. If the individual instead has to rely on others to do most of these things for him, failure of any of these skills may result in accidents, which clearly can interfere with any systematic attempt to strengthen bladder or bowel control. In fact, the improvements in toileting reported in some studies which only dealt with toilet voiding were either small, temporary, or could be attributed to staff vigilance and frequent trips to the toilet.

For these reasons it does not seem reasonable to investigate the factors which may strengthen and control only one of the elements of toileting when many are absent. However, if we examine the contribution of contingency, or any other factor for that matter, in relation to acquisition of the entire sequence, further difficulties arise, since the application of consequences is not effective on its own (see Chapter 3). Once other training procedures are introduced, it becomes difficult to isolate the contribution of each one, especially when a number of related and predetermined responses are being established in sequence. This problem was mentioned earlier in relation to imitation (Baer et al., 1967; Lovaas et al., 1966). Consequently, it is not surprising that no reports could be found of the contribution of contingency to the acquisition of complex sequences of behaviour. The implicit assumption has been that its demonstrated importance in relation to low probability unitary responses or response classes will be mirrored in complex sequences. However, when a number of training procedures are combined, the control which contingency exerts may be reduced, or at least may depend on the nature of one or more of the other procedures. This issue is both theoretically and practically important and is addressed in the study reported in Chapter 6.

4.3. GUIDANCE

The second training strategy which has become a common part of toilet training consists of a set of skill building procedures. These have been variously referred to as shaping, prompting or physical guidance. These terms appear to be used loosely and often interchangeably in the toilet training literature, although the procedures to which they refer are rarely described in any detail. However, several reports of complex toilet training programmes have specified the skill building procedures used (Azrin & Foxx, 1971; Foxx & Azrin, 1973a, 1973b; Mahoney, Van Wagenen & Meyerson, 1971; Singh, 1976). These have generally consisted of standardized verbal and gestural prompts, physical manipulation of the trainee's body and systematic fading of both until performance is independent. The following discussion will therefore concentrate on prompting in conjunction with physical guidance. For the sake of simplicity, the term 'guidance' will be used to designate these procedures throughout.

The modification of retarded behaviour has largely relied on the principles derived from the experimental analysis of operant behaviour in the laboratory, and its major focus has therefore been the manipulation of contingent consequences to strengthen, maintain or weaken behaviour (Kiernan, 1974). The main concern of experimental operant studies has been the factors which govern the rate, topography and timing of performance rather than initial response induction and acquisition (Harzem, 1975; Millenson & Leslie, 1979; Sidman, 1960). However, the purpose of much applied behaviour training with retarded persons has been to establish behaviour which either does not exist or rarely occurs. In such cases some method is required which will induce and facilitate the response in order for it to then be strengthened.

Shaping through the differential reinforcement of successive approximations to the desired response has been the method most commonly used to induce the simple responses studied in the operant laboratory (Millenson & Leslie, 1979). Although shaping has also been used successfully to establish significant new behaviour in humans, it can often prove an ineffective or, at best, a laborious process (Bandura, 1969). Consequently, many applied workers have turned to methods outside the experimental operant framework. These have included verbal instructions, modelling and guidance (Bandura, 1969; Kiernan, 1974). Imitation of a model and the factors which affect its influence on response acquisition have been widely studied (Bandura, 1969; Millenson & Leslie, 1979). However, verbal instructions, non-verbal prompts and, to a greater extent, guidance, have been largely regarded as subsidiary eliciting techniques which have little influence on the acquisition process per se.

Guidance has been a particularly common technique in the teaching of new skills to retarded persons (Kiernan, 1974). However, to this author's knowledge, there has been no investigation of the influence of guidance on response acquisition within the applied operant framework. Nor has guidance received much attention in other areas of learning research, although a few reports have appeared in relation to problem solving, maze learning and pursuit tracking from time to time, since Thorndike first raised guidance as an issue in 1898.

Guidance can involve either a 'forced response' technique in which the organism is passively moved through the required response, or physical restriction in which performance errors are blocked. Frequently both aspects are involved (Holding, 1965). Both methods create an errorless learning situation. Early studies of animals presented with puzzle boxes indicated that the forced response method considerably reduced the time taken to learn the solution and also enabled animals to perform successfully after failing to learn without guidance (Cole, 1907; Hunter, 1912). This enhancement of learning occurred even though both guided and unguided animals received immediate food reward for every solution.

Several studies employed the forced response method in animal maze learning. Alonzo (1926) attached collars and leads to rats and drew them through the correct path in the maze. When compared with the usual trial and error method in which the animal ran freely through the maze, the forced response method considerably reduced the number of errors in later unguided test trials. The time of running from start to goal box was also enhanced by guidance, but only by a very small amount.

Three later studies found that pulling the animal through the maze on a trolly was also effective in reducing errors and running time, even though the animal made no running movements and only saw the food in the goal box (Gleitman, 1955; McNamara, Long & Wike, 1956; Pritchatt & Holding, 1966). Moreover, Pritchatt and Holding found that the advantage gained as a result of the trolly rides occurred whether the trolly moved from start to goal box or vice versa. However, errors were reduced significantly more by forward guidance.

Restrictive guidance also appears to facilitate learning. This was demonstrated in a study of discrimination learning in rats (Maier & Klee, 1945) which were trained to jump from a stand at one of two doors across a gap. When the task was made insoluble by placing the food behind either door on a chance basis, the rats developed a fixation and continually jumped at the same position or figure. They continued to do this even when the reward was again attached to one particular position or figure.

These fixations were extremely resistant to correction, even after hundreds of discrimination trials. However, manually preventing the rats from jumping at the incorrect door did overcome the fixation. In addition, more rats who had experienced ordinary discrimination training and had not developed fixations learned a new discrimination better when they received guidance than when they were left to learn by trial and error. Moreover, when presented with a new discrimination problem to be learned by trial and error, only 6 percent of rats, which had previously experienced guidance, developed fixations compared with 36 percent of previously unguided rats (Maier & Ellen, 1952).

Physically restricting human subjects from making errors in maze learning similarly lowered errors and the number of trials to criterion during later unguided trials (Koch, 1923). The effect, however, was not as dramatic as with the forced response method, probably because human mazes are traced without the help of vision, and the learners were unable to tell which parts of the maze edge were fixed and which were blocked pathways.

Human maze learning has also been studied under forced response guidance. With this method the experimenter held the stylus just below the learner's hand and moved it along the correct path (Ludgate, 1924; Melcher, 1934; Wang, 1925; Waters, 1930). These studies all showed that forced response guidance had a greater facilitatory effect on learning than the restrictive method (Holding, 1965). For instance, Ludgate (1924) reported less trials to criterion with this method than were required under restrictive guidance as used by Koch (1923).

Von Wright (1957) pointed out that it is not the movements required in maze learning which have to be learned, but the perceptual structuring of the path. Consequently, blind folded guidance, whether restrictive or forced response, is an inefficient method of facilitating maze learning, since it does not allow the learner to identify the relevant characteristics and choice points in order to construct a picture of the true path. This was suggested as the reason for the fairly small advantage resulting from guidance in human maze learning compared with the considerable gains found in animal maze learning. Animals in a maze have input available through all senses, and in the guidance studies could see down all alleyways, even those that were blocked.

Further confirmation of this view was provided later by Van Duyne (1971) in a study of discrimination learning in four-year-olds. The discriminations required were blue-yellow and square-circle. Sixteen children were selected who demonstrated prior ability to recognize these stimuli. They were divided into four groups equated for general intelligence, verbal ability, psychomotor skill, attention span and emotional maturity. The task was to press the square to a blue (or yellow) light and the circle to a yellow (or blue) light. The two lights were presented in random sequence over 38 trials.

Neither imitation nor guidance alone led to more correct responses on either task than would be expected by chance. However, with the addition of verbal prompting, correct responding was significantly better than chance. Discrimination tasks, like maze learning, do not require new motor skills. Instead, they involve correct direction of attention and perceptual activity. The verbal description in this study may have oriented the children to the salient features of the display and thus enhanced learning. Guidance and observation of the experimenter performing the task did not highlight the salient features and, indeed, may have oriented the children more towards the hand movements rather than the display (Zaporozhets, 1961).

The influence of guidance on moment to moment adjustive skills has also been studied in relation to tracking tasks. Adjustive tasks of this nature require new motor skills and thus have more in common with toileting skills for which guidance has been used than tasks which are primarily perceptual. Two groups of studies will be considered here. The first two studies dealt with a discrete adjustive movement. It required the individual to grasp a knob or lever which was mounted on a track along which it could slide. The task was to move this object along the track by hand for a defined distance without the help of vision or in some cases, hearing.

Holding and Macrae (1964) used this task to compare forced response and restrictive guidance with knowledge of results and a control condition. They found that knowledge of results and restrictive guidance led to significantly greater improvement than free practice or forced response guidance.

In a second experiment with modified apparatus, both the original pushing movement and a releasing task were studied (Holding & Macrae, 1964). The latter consisted of holding a sprung lever while it was pulled along the track by a spring and releasing the lever when the required point on the track was reached. This releasing action stopped the lever movement. Forced response guidance entailed the learner holding the lever as it was pulled along to the required point, where a stopper released the lever and stopped the movement. Restrictive guidance required that the learner pushed the lever until it came up against a stopper at the correct position on the track.

The push task was again affected in the same way by the two guidance methods. Restrictive guidance enhanced learning more than forced response guidance. However, performance of the release task was significantly enhanced by the forced response method, while restrictive guidance led to only a small improvement. This was a reversal of the effects seen in the push task. It was suggested that the type of guidance which would enhance learning depended on the match between the guided movements and the movements required by the actual task.

The second group of studies involved pursuit tracking. This task required the individual to continually locate a moving target and make continuous motor adjustments to keep pace with it. The effect of forced response guidance on the learning of this task was investigated by Holding (1959). The learner moved a knob in order to keep a pointer on the track as it moved vertically in front of him. During the guidance condition, the learner held the knob while it moved automatically to keep the pointer on the track. Both guidance and trial-and-error learning reduced errors by amount the same amount. However, it should be noted that this task was learned very quickly so that all subjects reached a ceiling in several minutes. It is possible that guidance would be superior to trial-and-error learning with a more difficult task which took longer to learn.

A later study did investigate guidance with a task which took longer to learn (Macrae & Holding, 1965). They used a discrete tracking task in which a lever was moved to extinguish a random sequence of lights on a display board. The effects of small and large amounts of guidance in high and low error tasks were also investigated. The more difficult version of this task involved reversing the display-control relationships. More errors were made on this task. Guidance was provided by automatic correct movements of the lever while the learner was holding it. This time guidance had a clear effect, with a large amount of guidance resulting in significantly higher scores than small, and both being significantly better than no guidance.

Bilodeau and Bilodeau (1958) also compared guidance with no guidance. However, in their study, guidance was restrictive rather than forced response. The task was to move a clover leaf path under a pin as quickly as possible by co-ordinating the movement of two handles. Scores consisted of the number of contacts along the path which emitted a click as they passed under the pin. During training the guided group achieved consistently higher scores than the unguided group, and the advantage of guidance was greatly magnified when much longer training was given. It was suggested that extending the training period allowed learners to rely almost solely on visual and proprioceptive cues by the end than on binding against the walls of the path or on the presence or absence of clicks as they traced the path. External stimulus control was thus transferred to internal control, hence the increased advantage with extended training.

The usual environmental influences which have been considered crucial in the learning of voluntary responses are the immediate consequences of those responses. These can be in the form of extrinsic reward or knowledge of results. The effect of guidance as compared with knowledge of results were studied by Lincoln (1956). The task was to turn a handwheel of 15 cm diameter at a constant rate of about 100 rpm. This was attempted without the use of vision. Performance improved considerably under both conditions. However, initial improvement was greatest under guidance. Towards the end of training, improvement was greatest with knowledge of results. During a return to baseline after training, all groups performed about the same.

Holding and Macrae went further to examine a number of aspects of guidance which may make it more or less effective in training a response. In the study described earlier (Holding, 1959), two extra groups were run. One received guidance while blindfolded, and the learners in the other sat with folded arms while watching the pointer and the knob as they moved automatically to follow the track. Visual observation contributed about

60 percent in terms of the error saved by full guidance, while kinaesthetic guidance contributed only about 20 percent.

Two further aspects were studied by Holding and Macrae (1966). These comprised the speed of movement forced by guidance and how much voluntary action was possible during guidance. Slow guidance at the 'natural' speed of movement used by new learners was superior to fast guidance, and partial guidance, allowing some voluntary movement, was more effective than full guidance. It was postulated that slow and partial guidance provided more information about the nature of correct responses.

Finally, the effect of guided tracking of simple, intermediate and complex paths, before testing on the intermediate path, was investigated (Macrae & Holding, 1966). The tracks to be followed were provided by a green spot moving in a simple or two increasingly complex sine wave patterns on an oscilloscope tube. Each of three groups were trained to follow one of these patterns with a pointer operated by a control knob. Half of each group practised with no help, while the other half received full guidance by holding the knob as it moved the pointer automatically.

Unguided practice was accompanied by increasing errors with increased track complexity. Guidance at all three levels of complexity led to better initial performance on the intermediate track during test trials, with faster progress than resulted from trial-and-error practice.

From this research it appears that physical guidance facilitates learning by both reducing or preventing errors during acquisition (Holding, 1965; Welford, 1968), and by showing what is to be done and how it is to be done (Holding & Macrae, 1966). These two latter functions can be characterized as providing task information and response information. When either or both these types of information are provided, performance after guidance is better than after no previous training, and learning can occur as a result of passive movement even without knowledge of results. However, whether learning is better with guidance than with trial-and-error depends on a number of factors. These include the amount of guidance during acquisition, the form of guidance used, and the nature of the task.

For practical purposes the optimum amount of guided practice will vary from task to task. In the discrete tracking task used by Macrae and Holding (1965), nine guided trials enhanced learning more than one guided trial. Lincoln's (1956) subjects made their largest improvements in achieving a standard rate of turning a handwheel during the first two trials with very little additional improvement after that.

The fundamental determinants of guidance effectiveness, however, appear to be the kind of information required to perform the task and whether the guidance used provides that information. Thus, when successful performance of a task relies primarily on perception and recall of the stimulus changes to be achieved, the most effective guidance will orient the learner to these rather than to motor responses. Conversely, when the major demands of a task are co-ordinated movement, the most effective guidance will highlight the response rather than the perceptual aspects.

The most telling demonstration of the importance of information match between task and guidance occurred in the study by Macrae and Holding (1965). Of the two forms of guidance used, each was effective with only the task which it most nearly matched. Analysis of the guidance and tasks indicated that the restriction method gave task information by orienting the learner to the end point of the movement. Since the release task relied heavily on perception of the end point and very little on the form of the movement used to reach it, this was the guidance that was most effective. Similarly, forced response guidance gave primarily response information, which was the major demand of the push task.

In the 1966 study by Holding and Macrae, guidance which forced the response at the speed naturally used by new learners conveyed the required information more efficiently than guidance at a faster rate. Of even more interest was the superiority of partial guidance which allowed some voluntary movement, thus making more information available. The extra information concerned incorrect movements, which nevertheless were defined as incorrect by the resistance which they met. This is much the same kind of information about alternatives provided by the view of wrong alleys through the barriers in the animal maze learning studies. It may be that knowledge of alternatives is crucial information during the learning of perceptual-motor skills (Holding, 1965) and that guidance which does not provide this is reduced in effectiveness.

4.3.1. Guidance and adaptive behaviour

Interest in guidance as a facilitator of learning did not continue after the series of studies discussed above, although the evidence indicated that it could be an important factor in perceptual motor learning, and went some way towards defining how guidance could be arranged for the best effect. However, the studies all employed fairly artificial tasks in highly controlled conditions. The question remains whether these findings would be repeated with adaptive skills in a more normal environment.

Only one study by Kirillova could be found which considered guidance in relation to adaptive motor behaviour. This was referred to in a report of Soviet research (Zaporozhets, 1961). Children ranging in age from three to seven years were taught motor skills by either 'mechanical guidance' involving 'passive movements' or imitation of a model. The younger children took less time to acquire the skills with guidance than with imitation. With increasing age imitation became more effective, so that by five or six years of age both methods were equally effective. By seven years of age imitation was the more effective method.

This study raises some important issues concerning the development of organisms which may throw further light on the function of guidance. Teitelbaum (1977) has argued that behaviour is an hierarchically organized structure which becomes increasingly voluntary with age as increasing encephalization transforms the basic inbuilt reflexes into more variable responses, by gradually integrating them with the different sensory modalities. At lower levels of encephalization early in development, behaviour is less co-ordinated with sensory input, especially through the distal senses, which therefore cannot direct and organize motor activity in more than a rudimentary way.

This conceptualization resembles the development of investigatory orienting reflexes postulated by Soviet researchers (Zaporozhets, 1961). Orienting activity begins as unorganized perceptions of discrete incoming stimuli which have conditioned or unconditioned significance for the organism. However, as cortical organization develops, orienting investigatory activity selects, intensifies and orders particular sensations arising from an object or situation in relation to each other to form an image. This image can then regulate movement in relation to the object or situation, so that it becomes voluntary rather than reflexive, and more complex. In the early stages of development, motor-tactile orientation, being closest to motor execution, is dominant. Later, the distal senses are integrated, and eventually speech, as a representation of image, is able to direct and control movement.

This view suggests that the younger children in Kirillova's experiment learned new motor behaviour more effectively with physical guidance than with imitation because their orienting activity relied more on motor-tactile than visual input. Observing a model may have led to better acquisition in the older children because vision had been integrated into orienting activity by that age. At the same time as these changes occurred, learning under both training modes became faster as behaviour became increasingly regulated by orienting activity.

Other evidence supporting this view of the development of perceptual control of motor behaviour was cited by Zaporozhets. For example, young children used considerably more touch and manipulation to familiarize themselves with strange objects. However, to begin with, they turned the objects around with their fingers in an unorganized fashion so that contact with the object was constantly lost, and they were unable to discover the specific features. With increasing age, manipulation became more organized, and purely visual orientation increased. However, even the older children reverted to tactile orientation when objects were introduced which had no familiar characteristics.

The interpretation of these findings can also be related to the guidance studies with adults. In the studies of maze learning and discrete adjustive movements, learners were prevented from using vision and, in some cases, hearing. Therefore, they were left with only the kinaesthetic senses from which to create an image of the task. Moreover, the tasks were unfamiliar and performed in a highly artificial situation. This was so even for the continuous tracking tasks in which vision was involved. It is possible that under such unusual and difficult conditions physical guidance considerably assists orienting activity, because learners fall back on motor-tactile orientation to organize their movements.

The converse may also be true; that is, with adaptive tasks having some familiar components, performed in a more familiar environment, and with input available through all sensory modalities, guidance may confer little or no advantage during acquisition. This was certainly the case for the older children in Kirillova's experiment.

4.3.2. Guidance and retardation

There has been no investigation of the efficacy of guidance in applied studies of motor skill learning with retarded persons. This field has been dominated by the operant conditioning model since the 1960s. Consequently, the emphasis has been on the manipulation of contingent reinforcement and punishment. Within this model some emphasis has been given to arranging discriminative stimuli so that they direct orienting activity to the salient preliminary cues which signal that a particular behaviour is appropriate.

Within this framework physical guidance has been regarded as one of several methods of establishing stimulus control and has become a common ancillary technique in many training programmes and studies of behaviour acquisition (Kiernan,1974). However, its inclusion in training has occurred without reference to evidence for its effectiveness. Presumably, the decision to provide guidance has been made intuitively or on pragmatic grounds, since the traditional means of operant response facilitation appeared too cumbersome, especially when complex skills were involved.

If guidance provides the required response and task information and is effective in the training of adaptive motor skills, it probably does more than establish preliminary stimulus control, as discussion in the previous section would suggest. Rather, it should assist in orienting the individual to moment by moment stimuli arising from his or her actions, and establishing these as an image or motor programme to generate and guide the movements during subsequent performance (Holding & Macrae, 1966; Kiernan, 1974). As a training technique it would therefore have a quite different function from either discriminative setting stimuli or response consequences. It could be regarded as adding another dimension to behaviour training, over and above the contribution of the usual operant strengthening techniques.

Guidance which has this function may be particularly effective in motor training with retarded persons. They are frequently characterized as having neurological deficits (Clarke & Clarke, 1974; Ellis, 1969), specific deficits of attention (Denny, 1966; Zeaman & House, 1963), or as being slow to develop (Clarke & Clarke, 1974; Zigler, 1969). In the event that any or all of these characterizations apply, it is likely that cortical control of behaviour and organisation of orienting activity has not developed to the level found in non-retarded peers, especially where young or severely retarded individuals are concerned. As a result they may rely on motor-tactile input, and guidance may be a particularly appropriate form of training, as it was for Kirillova's youngest children, because it directly assists perceptual organization and control at this level.

4.4. INCREASING BEHAVIOURAL CONTROL

A major difference between applied studies of operant behaviour and laboratory research lies in the kinds of responses selected for study and the reasons for their selection. In laboratory studies the emphasis is usually on discovering general principles which govern the effects of specific phenomena on behaviour (Sidman, 1960). Although the behaviour considered may be of intrinsic interest, it is generally selected as a convenient and typical example of operant behaviour, which will presumably follow the same laws as any other voluntary response. Therefore, simple responses are chosen which are "easy to emit, observe, record and integrate with stimulus operations" (Bijou & Baer, 1966), are amenable to precise definition, and are potentially variable over a wide range on at least one dimension (Sidman, 1960). The rate of responding has been the most frequently used dimension because it displays wide variability and is sensitive to subtle changes in environmental conditions (Skinner, 1966). This approach to the selection of responses and response dimensions to be studied has allowed behavioural control techniques, observation and recording to be refined and automated so that the effects of experimental manipulations can be clearly isolated, free from interference from uncontrolled variables, including the process of observation itself.

In applied studies, on the other hand, it is usually the behaviour which is of central importance, because its absence or excessive occurrence creates significant social and adaptive problems for the individual. Such behaviour rarely has the convenient characteristics sought in laboratory research. This is especially so in relation to retardation, where "the rate at which a simple response will be repeated is seldom an important question", and the aim is "rather to shape relatively complex patterns of response to occur in correct sequence, and in only the appropriate situations" (Harzem, 1975, p. 104).

Complex patterns of responding are not readily subjected to automated control, observation and recording. In addition, the purpose of much applied research is the establishment of adaptive responses which the individual can then use in his or her daily life. Therefore, behaviour shaping and strengthening often takes place either in the natural environment or in a setting which has many of the characteristics of that environment. Such environments by definition contain many uncontrolled factors. Furthermore, a primary aim is often to bring the behaviour under the control of consequences delivered by other persons in that environment or to change existing stimulus-response-reinforcement patterns of social interaction. In these circumstances improved control techniques may actually conflict with the practical aims of the research. Therefore, the problems involved in maintaining the practical value of applied research ventures while increasing behavioural control and the reliability of observation and recording have become central issues for applied researchers (Kiernan, 1974).

Response detection and techniques for ensuring that the delivery of consequences occurs as planned have received particular attention in applied research (Kiernan, 1974). The most common situation will serve as illustration. The experimenter wishes to accelerate a behaviour which is considered to be of adaptive significance, but which the individual rarely emits. The behaviour is observed and recorded for a period of time and then consequences are applied. The experimenter personally delivers a reward following each emission of the behaviour. Under this condition the behaviour is observed to occur with increasing frequency. The programmed reward is then omitted and the frequency with which the behaviour occurs is observed to decrease until the reward is again applied, when the behaviour increases to its former frequency.

In reporting the study, the experimenter generally describes how and when the rewards were delivered during the experimental condition, but no evidence is supplied to show that this actually occurred as planned, although the results are presented as evidence for the influence of immediate reward on a continuous schedule. However, it is conceivable that the experimenter may have failed to detect a number of responses and therefore failed to deliver reward on those occasions. In that event, it may be some unspecified schedule of intermittent reinforcement that influenced acquisition rather than the planned continuous schedule. It is also possible that the experimenter was slow to deliver rewards on some occasions so that some other behaviour following the target behaviour was adventitiously strengthened at the same time. In that event what was acquired may actually have been a chain of two or more responses on multiple schedules. Failure to recognize this could have serious implications for future attempts at replication, for generalization, and for transfer of control of the targeted response to naturally occurring contingencies.

For these reasons the behaviour controls involved in timing and scheduling are fundamental to demonstrations of the operation of consequences and are rightly emphasized in most discussions of behaviour modification methodology (Gardner, 1971; Kiernan, 1974; Krumboltz & Krumboltz, 1972; Neisworth & Smith, 1973; Watson, 1973b). However, while many researchers are aware of the importance of behavioural controls and carefully describe their experimental procedures, the reader is usually left to accept on faith that the delivery of consequences was as described.

An admirable study by Thompson, Iwata and Poynter (1979) makes it clear that this faith may not always be justified. The aim of their experiment was to reduce tongue thrusting during mealtimes in a ten-year-old, profoundly retarded boy with spastic cerebral palsy, with whom traditional treatment had no effect. The boy could not feed himself and had to be positioned carefully and secured in order to remain upright during meals. An effective treatment was sought because pathological tongue thrusting can lead to serious nutritional problems, dental malocclusion and distortion of speech. The treatment was introduced as condition B in an ABAB design. During treatment food was only presented when the tongue was inside the mouth and, whenever the tongue moved out of the mouth past the middle of the lower lip, it was gently pushed back into the mouth with a spoon.

The occurrence of several responses and contingent pushback were recorded throughout by independent trained observers using a partial interval observation system (Powell, Martindale & Kulp, 1975). The observations of interest here are of tongue thrust and pushback. Inter-observer agreements ranged from 67 percent to 91 percent for tongue thrust and from 91 percent to 95 percent for pushback. In addition, the percentage intervals during which tongue thrust and contingent pushback occurred were graphed, showing that some tongue thrusts were not followed by pushback during most sessions, while pushbacks occurred on a few occasions when tongue thrusts were not recorded. A further check on procedural accuracy was made by comparing intervals scored for each of the two events. This yielded 84.9 percent concurrence.

The 15.1 percent error rate may have reflected inaccurate observations, since observer reliability was less than 100 percent. It may also have indicated that the experimenter did not detect all tongue thrusts and therefore did not pushback following every occurrence. Alternatively, it may have indicated that on some occasions contingent pushback was considerably delayed. The system of observation provided 7.5 second observation intervals followed by 2.5 seconds as recorded by independent observers. Thus, even if a tongue thrust had been recorded in one interval and a pushback in the next, there would have been at least 2.5 seconds delay between the response and the consequence. Since the experimental procedures considerably reduce tongue thrust, the procedure was judged practically to be effective. However, an understanding of the precise nature of the controlling variables is not possible, since continuous, immediate pushback may not have occurred as planned. This may create interpretation problems in future replications, especially if similar control of tongue thrust cannot be demonstrated.

The careful training and monitoring of observers and analysis of control procedures in the Thompson et al. study were post hoc rather than a direct attempt to increase control during the study. Moreover, the analysis did not show which aspects of procedure contributed to inaccuracy of behavioural control. Holz and Azrin (1966) have provided an excellent discussion of methodological problems relating to response detection and the delivery of consequences, together with techniques to increase control of these aspects of procedure. Although their paper was specifically concerned with the conditiong of human verbal behaviour, much of their discussion is equally relevant to applied studies in general. The problems which they described arise specifically because the provision of consequences involve human activity. There may be difficulty in defining and therefore reliably recognizing the responses of interest so that these can be treated consistently. The experimenter may be unable to meet the demands of recording, reinforcing and programming his or her own behaviour in quick succession, so that delivery may be unreliable. In addition, the experimenter may have expectations which systematically influence not only the observation record but also the behaviour of subjects. However, as in laboratory research, the identification of these aspects has generally been seen as a methodological issue rather than as the object of investigation per se (Sidman, 1960).

One exception is the extensive research into experimenter expectancy effects (Rosenthal, 1969, 1976). Unlike other methodological issues, experimenter effects in behavioural research are seen as having importance for the study of human interaction in general (Rosenthal, 1976). Of particular interest here is the evidence for expectancy effects in response detection and the delivery of consequences. Systematic effects have been demonstrated in both animal and human research. When experimenters were given certain expectations concerning the abilities of their animal subjects, the actual performance of the animals during learning experiments accorded with those expectations. It was found that experimenters who were told that their animals were superior reported that they observed more closely during the experiment than those who believed that their subjects were inferior (Rosenthal & Lawson, 1964). This may very well have led to more rapid and appropriate reinforcement of the desired response. Hence, the superior performance of their rats may have resulted from more accurate response detection and reinforcer delivery.

Most studied of expectancy effects with human subjects have not used performance during learning as the dependent variable. Expectancy effects have been found in studies of psychophysical judgements (Zoble, cited in Rosenthal, 1969), person perception (Rosenthal & Fode, 1963) and educational achievement among children (Beez, 1968; Meichenbaum, Bowers & Ross, 1969; Rosenthal & Evans, cited in Rosenthal, 1969; Rosenthal & Jacobson, 1968). Two unpublished studies by Kennedy and colleagues that did look at performance during learning were cited by Rosenthal (1969). The dependent variable was amount of conditioning during a verbal conditioning experiment. Experimenters who expected greater conditioning obtained greater conditioning than experimenters who expected less conditioning. However, this effect appeared only when experimenters worked face-to-face with their subjects but not when they sat out of visual range behind their subjects.

Rosenthal (1969) also reported the findings of an unpublished master's thesis by Johnson, whose study looked at children's rate of marble-dropping under social reinforcement. The expectancy effects were very carefully isolated from observer bias by having the responses recorded automatically and collated by a second person who was unaware of the expectancy conditions under which subjects responded. Again, experimenters who expected a greater increase in the rate of marble-dropping obtained a greater increase than those who expected a lesser increase. These and other studies suggest "that an experimenter's expectancy may be an unintended determinant of the results of his research" (Rosenthal, 1976, p. 331). In studies of behaviour change it may well be that the speed and accuracy of response detection and of the delivery of consequences are at least two classes of experimenter behaviour which mediate the influence of expectancy on subject performance.

While the studies discussed so far provide some evidence for the importance of methodological considerations in behavioural research, none has been found which directly examine the effectiveness of techniques to increase the reliability and consistency of response detection and the delivery of consequences. Generally, such techniques have been described as methodological improvements, with no direct evidence to show that they did in fact achieve increased control.

A number of methods have been advocated to either control for or assess the effects of experimenter expectancy (Rosenthal, 1976). One method involves making the experimenter "blind" to the subject's treatment condition. This can be achieved when the nature of the experimental treatment does not rely on direct interactions between experimenter and subjects. For instance, in a study of the effects of a drug on behaviour, the experiment can be arranged so that the experimenter does not know which subjects are receiving the drug and which the placebo until after the behavioural data have been collected. It is also possible to ensure that experimenters are "blind" if the purpose of the experiment is to investigate the influence of a non-interactive variable on subjects' responses to an interactive treatment. However, this method is not possible in most applied studies of operant behaviour, since the variables of interest are the interactive treatment itself as well as the observable behaviour of the subject during treatment, neither of which can occur without the experimenter's knowledge.

Although it may not be possible to control for expectancy effects, it may be possible to treat expectancy as one of the independent variables so that its contribution to the results can be taken into account during the analysis of results. This method is illustrated by Burnham's study (cited in Rosenthal, 1969) of the effects of brain lesions on rats' performance in a T-maze discrimination problem, in which the experimenters' beliefs concerning the subjects' neurological state and the actual state were both found to be significantly related to performance.

A variety of other methods have been used to reduce expectancy effects and increase control over experimenter behaviour. These include the use of a number of experimenters in order to cancel unknown biases and increase the generality of results (Rosenthal, 1976), the refinement and coding of response definitions (Holz & Azrin, 1966; Patterson, Cobb & Ray, 1972), extensive training of experimenters (Rosenthal, 1976; Hall & Copeland, 1972), and cues to elicit appropriate experimenter behaviour together with feedback to experimenters about their performance (Herbert & Baer, 1972; Martin, 1972; Panyan, Boozer & Morris, 1970; Parsonson, Baer & Baer, 1974). In addition, the use of separate observers to record the behaviour of interest has become a common practice, thus leaving the experimenter free to concentrate on his or her performance vis-a-vis the subject (Hamerlynck, Handy & Mash, 1973). This practice also offers a further advantage in that the experimenter's behaviour can be observed and recorded (Rosenthal, 1976).

A paper by Hall and Broden (1967), which was discussed in Section 4.2.2, described the use of several of these methods in an attempt to increase the accuracy of teachers as reinforcing agents. Three studies were described which demonstrated increased rates of adaptive behaviour in brain-injured children through the systematic arrangement of contingent social reinforcement which was delivered by teachers who were initially unfamiliar with the principles of reinforcement. The behaviour of interest in the third study was social play. The first and most common method to control teacher performance was to release the teachers of any recording function.

Records during the first three days of the reinforcement condition indicated that social attention was given by teachers during only a few of the intervals in which social play had been scored. Therefore, three further techniques were employed to increase teacher accuracy. One was to restate and clarify the criteria for social play. The second was to supply more direct feedback to the teachers after each day's session. The third was to instruct teachers to also reinforce the child for looking towards other children at play. Since this latter behaviour occurred frequently, whereas social play rarely occurred, this procedure may have enhanced the teachers' vigilance and motivation, as well as shaping the child's response. The introduction of these procedures led to a marked rise in social play, thus providing indirect evidence that increased behavioural control had been achieved.

While considerable effort has gone into controlling experimenter behaviour to reduce error and bias in applied behavioural research, an alternative approach has been to eliminate experimenter-subject contact altogether (Rosenthal, 1976). This entails a degree of automation usually only achieved in the laboratory, but which is also possible when the response of interest is a simple, non-social response. For instance, in two studies both response detection and reinforcer delivery were completely automated, and strengthening was achieved of lever pressing in a crib-bound, profoundly retarded child (Bailey & Meyerson, 1969), and adaptive arm movements in profoundly retarded children with cerebral palsy (Murphy & Doughty, 1977).

These two studies are impressive demonstrations of how behavioural control which would be very difficult for a human experimenter to achieve can nevertheless be achieved with automated response detection and reinforcer delivery. The 50 days of continuous vigilance and procedural accuracy achieved by the apparatus in the Bailey and Meyerson study would have been almost impossible for human experimenters to achieve. Similarly, the judgements required in the arm movement study would have been extremely difficult for a human experimenter to make without the mechanically defined criteria provided by the apparatus.

Automation of response detection and the delivery of consequences has also made possible the modification of other responses such as sucking in infants (Kron, Stein & Goddard, 1963; Sameroff, 1965) and upright posture in severely retarded persons (Grove, Fredericks, Baldwin & Moore, 1977; Macurik, 1979), and has increased experimental control in the study of simple language responses (Lane & Shinkman, 1963; Lindsley, 1963; Shearn, Sprague & Rosenzweig, 1961). However, when the response of interest is complex or social, the use of fully automated response detection and delivery of consequences is rarely possible. Nevertheless, many investigators have attempted to increase experimenter accuracy and minimize experimenter involvement by employing methods which at least partially take over one or both these functions from the experimenter (Holz & Azrin, 1966; Rosenthal, 1976).

Assistance with response detection has been provided in some studies by having an independent observer signal the experimenter whenever the response to be consequated occurs (Allen, Henke, Harris, Baer & Reynolds, 1967; Bettison, 1974; Clark, Rowbury, Baer & Baer, 1973; Hawkins, Peterson, Schweid & Bijou, 1966; Pinkston, Reese, LeBlanc & Baer, 1973), or by defining the target behaviour in terms of a dimension which could be measured mechanically (Ayllon, 1963). Experimenter involvement in reinforcer delivery has been partially reduced by using remote control devices. For example, Patterson and his colleagues used a radio-activated auditory signal to an earphone worn by the subject in one study (Patterson, Jones, Whittier & Wright, 1965), and a remotely activated light and electronic counter in another (Patterson, 1965). In both cases subjects received tangible rewards at the end of each session corresponding to the number of signals delivered during training. Some responses are of a kind which lend themselves to the use of programmed electronic reward devices. For instance, Zeidler and Zimmer-Hart (1979) taught a physically handicapped, retarded child to walk using a radio which could only be activated by pushing two switches in sequence. The first switch was placed at increasing distances from the radio so that the child had to cross successively greater distances to push the second switch and hear the music.

4.4.1. Increasing behavioural control in toilet training

Self-toileting involves a complex set of responses and discriminations, and therefore investigators face a number of problems of behavioural control. These problems are common to the study of complex human behaviour in general. However, particular difficulties exist in relation to toileting because of the nature of the central response of voiding. The muscle action involved in voiding is internal and therefore not directly observable. Consequently, only the product of that muscle action, in the form of deposited urine or faeces, can be detected.

Behavioural products are often used as measures of performance; for example, a completed match-to-sample in discrimination training or a completed set of work sheets in educational training. In such research, training sessions are of limited duration and the responses are often elicited by instructions or physical prompts. In these situations, the movements made by the subject alert the experimenter to be ready for the completed product, which is usually quite obvious. Furthermore, the experimenter has only to remain alert during the limited period of the training session. This is not the case with voiding, whose occurrence largely depends on unobservable physiological factors. It cannot be programmed by the experimenter, although some control may be exerted over the frequency and timing of voiding through the provision of extra drinks (Azrin & Foxx, 1971; Van Wagenen, Meyerson, Kerr & Mahoney, 1969), or medication to induce defecation (Schaefer, 1979). A further problem arises because voiding usually takes place in the toilet or clothing where it often is hidden from view or goes unnoticed.

These characteristics of voiding make detection and therefore immediate delivery of consequences particularly difficult. A number of investigators have attempted to overcome the problem of response detection by designing electronic detecting devices. The first of such devices, for use with small children, was described by Van Wagenen and Murdoch in 1966. It consisted of a wire grid sewn into the child's pants and connected to an electronic alarm device worn in a small package at the waist. The device emitted a tone whenever urine or faeces came into contact with the grid, thus alerting the trainer that voiding had begun. This ensured that non-toilet voiding could be detected.

A modification of this device, so that it would detect all urinations wherever they occurred, was reported by Van Wagenen, Meyerson, Kerr and Mahoney (1969). Instead of the grid in the pants, the child wore a belt from which a plastic or rubber urinal was suspended beneath the urethral opening. Urine passed over sensing electrodes in the urinal, triggering the sounding of a tone, and then passed through an orifice at the bottom. This device was tested with nine incontinent retarded children between four and nine years of age. This was one of the first reported uses of a response detecting device as part of training for fully independent toileting.

Neither of the Van Wagenen devices detected all voiding. The first version did not detect toilet voiding, while the second was unable to detect defecations. Azrin, Bugle and O'Brien (1971) overcame these problems with two alarm devices, one in the pants to detect non-toileted voiding, and one in the toilet to detect all toilet voiding. The alarm was set off when moisture bridged the gap,thus closing the circuit between two studs which were placed approximately one inch apart. With this arrangement the device could be attached in many placed. Azrin et al. attached one to the pants and one to a pot or bowl in the toilet. The pants alarm emitted a tone and the toilet alarm emitted a click to enable the trainer to detect where voiding occurred so that different consequences could be applied. Azrin and his colleagues tested these devices with four retarded children and then went on to design additional procedures to train fully independent toileting (Azrin & Foxx, 1971; Foxx & Azrin, 1973b).

Since these first reports, a number of investigators have designed variations resulting in improvements to the accuracy, size, flexibility and robustness of the devices as well as in the type of signal generated (Corey & Dorry, 1973; Dixon & Smith, 1976; Fried, 1974; Herreshoff, 1973; Kashinsky, 1974; Smith, 1977; Yonovitz, 1976; Zimmer-Hart, 1977). In addition, similar devices have been used in toilet training to reduce soiling in a partially deaf child after successful surgery for Hirschprung's disease (Logan & Garner, 1971), with profoundly retarded children who were blind (Song, Song & Grant, 1976) or deaf blind (Lancioni, 1980), and by parents of a profoundly retarded child (Litrownik, 1974). A further variation was reported by Hamilton (1971) to be used in a programme to strengthen self-initiated toileting in profoundly retarded females. The device consisted of a buzzer at the door into the toilet area. Trainees were reinforced for pressing the buzzer to gain access to the toilet. When buzzer pressing was established it enabled trainers to detect self-initiated toilet approaches in a busy ward setting, and thus be ready to then prompt correct performance and reinforce toilet voiding when it occurred.

Two studies have evaluated these detection devices (Madsen, Hoffman, Thomas, Koropsak & Madsen, 1969; Wright, 1975). In the Madsen et al. study, normal children between 12 and 35 months were randomly allocated to five groups so that each group contained at least three children in each of four age levels. The children's mothers carried out all procedures after instruction from the investigators. One group acted as a control group and received no toilet training. A second group were trained with the mothers' own methods. Of the three experimental groups, one was toileted according to a predetermined schedule, and rewards were given for increasing time spent on the pot and for voiding in the pot. The second group used a pants alarm which signalled the onset of any voiding in the pants. The mothers were instructed to pot their children immediately the alarm sounded. The third group combined the procedures used by the first two groups. Records of the number of pot voidings and the number of voiding accidents were kept for one week before training, for the four weeks of training, and for one week after training.

All groups improved to some extent on both measures. Reinforcement was the important factor in increasing the number of pot voidings, since the reinforcement and reinforcement plus pants alarm groups improved significantly more on this measure than the other three groups. Both the pants alarm and reinforcement, either together or alone, were important factors in reducing accidents. Improvement in the three experimental groups was not significantly different on this measure, but it was significantly better than in the parent's methods and control groups. However, neither reinforcement or the pants alarm alone were as effective as the two procedures combined, although these differences were not significant.

The authors concluded that "the addition of the pants alarm added to the efficiency of training" (Madsen et al., 1969, p. 131). However, their study did not provide evidence as to how the pants alarm enhanced training efficiency. Not only did the sounding of the alarm assist the mother to detect when voiding had begun; the alarm could also have acted as a signal for the child which, because it was paired with the sensations associated with a full bladder or bowel, may have brought these into awareness as discriminative stimuli for toileting. This is especially likely since a second procedure was added with the pants alarm that was not used in the reinforcement condition. This consisted of immediately rushing the child to the pot, a procedure that could have acted as a negative reinforcer for voiding in the pants, besides ensuring that the child was on the pot at the times when voiding was most likely. Which of these aspects were important could be tested by running three further groups. In one group the alarm would be arranged so that only the mother detected it. This could be achieved by replacing the alarm box with a small transmitter, the signal from which was received via an earphone and receiver worn by the mother, who would pot the child on hearing the tone. A second group would use the same transmission system so that only the child detected the tone. In a third group the pants alarm would not be used. Instead, the mother would watch closely and pot the child whenever voiding was detected or appeared imminent.

Not only is it uncertain from the Madsen et al. study which aspect of the pants alarm procedure actually enhanced toileting performances, but the general finding that the alarms increased training efficiency can only be regarded as tentative, since no reliability checks of the mothers' observation or training accuracy were carried out. It is possible that the mothers in the different groups were set to expect the results they achieved by the prior publicity and instructions. All mothers volunteered their children after seeing television or newspaper news items presenting the pants alarm and reinforcement as an effective means of toilet training. Therefore, the two control groups were set to expect much less improvement than the three experimental groups, while those using only one of the procedures may have expected only partial success.

Wright (1975) also looked at the effects of two aspects of toilet training on the performance of retarded children, using an analysis of variance design. Four experimental groups, each containing four children, received positive reinforcement for toilet voiding. Subjects in two of the four groups also wore pants alarms which signalled when toileting was to occur, as in the Madsen et al. study, and in two did not wear alarms but were toileted at the most likely voiding times, as indicated by baseline records. In one group in each condition subjects also received a faded prompting and physical guidance procedure for teaching the socially required skills (Azrin & Foxx, 1971; Foxx & Azrin, 1973b), while in the other group subjects had these tasks done for them if they did not carry them out voluntarily. Two further groups received no training and acted as control groups. Training continued for 60 days, and continuous records were kept of accident rate, toilet voidings, self-initiated toiletings (including those where help was needed with clothing or other tasks), and fully independent toileting.

All experimental groups improved on all measures, while the two control groups showed no improvement. In addition, the prompt plus pants alarm group self-initiated significantly more than the other groups. Prompting, irrespective of whether the pants alarm was used, led to more fully independent toileting. Hence, it seems that the pants alarm increased the efficiency of training during acquisition, since by the end of training children in the prompt plus pants alarm group who had not reached full independence were self-initiating more, but the pants alarm did not affect whether or not children finally achieved full independence.

Although the actual function of the pants alarm cannot be determined from Wright's data either, these two studies together indicate that there may be some small advantage gained from using pants alarms to signal the onset of voiding so that the trainee can be rushed to the toilet.

Mahoney, Van Wagenen and Meyerson (1971) recognised the function of the pants alarm as an added cue for toileting and used it for that purpose, as well as for assisting in response detection. They tested their device with three 18 to 21 month old children and five older retarded children. The alarm could be set off either when urine or faeces came in contact with the pants, or when the trainer pressed a button on a small, handheld FM radio transmitter. This enabled the sequence of toilet approach, pants down and sitting on the toilet to be first established to the trainer-operated alarm, using prompts and reinforcement, so that, when voiding caused the alarm to sound, the same sequence would be carried out. Reinforcement was then given if this resulted in some urine or faeces being deposited in the toilet. In addition, when the alarm was set off by voiding, the trainer said "No, potty" and used whatever prompts were necessary to transfer performance of the toileting sequence from the alarm alone to the alarm plus the onset of voiding.

Smith (1979) compared this use of the pants alarm with the Azrin and Foxx (1971) method, using two groups of five retarded children. The two methods were modified so that they were as similar as possible. Both groups sat close to the toilet, were prompted to the toilet every half hour, were rewarded for voiding in the toilet, and were additionally rewarded every five minutes if they were dry. The prompts were gradually faded and, when self-initiated toileting was established, the children were gradually moved further from the toilet and the alarms were removed. However, in the Mahoney method, the trainer-operated alarm was an additional prompt. Moreover, when the alarm signalled a voiding accident, the child was prompted to go to the toilet in the Mahoney method, whereas an accident resulted in in a reprimand and time out from reinforcement for ten minutes in the Azrin and Foxx method.

All five children trained with the Azrin and Foxx method, achieved independent toileting in the twelve weeks allotted, compared with four of five trained with the Mahoney method. However, the difference in improvement for the two methods was not significant. Furthermore, the one child who did not reach independence was more resistant to training in general than the other children. However, trainers found the Mahoney method more difficult than the Azrin and Foxx method, and the Mahoney alarm devices were more expensive and bulkier. For these reasons, Smith favoured the Azrin and Foxx method, although there was little to choose between the two systems in terms of success rate.

As in the two comparative studies discussed earlier, the operation of the pants alarm was not the sole focus of study in the Smith experiment. Several other major differences in procedure accompanied the different uses of the alarm. Hence, one can only speculate on the actual role of the pants alarm in the two training methods. However, while Mahoney et al. (1971) recognised the function of the alarm as a discriminative stimulus for the learner, Smith was the first to discuss its possible complex effects on the acquisition of bladder control. He suggested that when toileting is established in response to the onset of voiding, as signalled by the pants alarm, it is tied to the stimulus of a full bladder. This may maintain a reliance on reflex voiding rather than inducing the voluntary control necessary to void before the bladder reaches its maximum capacity, a skill which ensures the preplanned voiding necessary for total accident free functioning during everyday activities. Thus, a device which was first introduced as a partially automated method to assist the experimenter with response detection, may in fact have quite complex effects on subject performance.

The complex interaction between methods to increase experimenter accuracy and subject performance is particularly likely in applied behavioural research, since the methods are generally experienced directly by the subject as well as by the experimenter. In laboratory research, on the other hand, the programming and response detecting equipment is generally outside the experimental space and only the results of its operation are experienced by the subject in a way which is directly controlled by the experimenter.

The toilet training studies discussed above deliberately made use of the subject's experience of the detecting device by incorporating it as a discriminative stimulus in the training procedures. However, as with any experimental treatment, its effects should be systematically investigated. It is by no means certain that the discriminative function of the pants alarm necessarily enhances the acquisition of toileting response. In fact, Smith questioned its value when used as a cue for toileting. Its function when paired with punishment for voiding accidents is also unclear (Wright, 1975).

A second methodological innovation described in the toilet training literature has involved the automation of reinforcement delivery for toilet voiding. Watson (1968) described the first attempt to develop such a device at Columbus State School. A framework was mounted over a conventional toilet, providing a seat and foot and arm rests. The framework housed equipment which bathed the toilet bowl with light beams focussed on photo-electric cells. Whenever urine or faeces broke one or more of the beams, a switch was triggered which delivered a reward through a dispenser beside the toilet. In order to prevent children from activating the device with a hand or foot or object, three safety switches, one in the seat and one in each arm rest, had to be closed before the dispenser switch would work. A child had to be sitting on the seat with a hand or arm on each arm rest before a reward could be delivered.

This device was tested with eight retarded children who were prompted regularly to go to the toilet. Five of the children consistently voided in the toilet during the eight week trial, while three did not void in the toilet at all. However, all children continued to have frequent accidents. Watson and his colleagues attempted to use a similar device in an experimental study of toilet training with severely retarded children (Hundziak, Maurer & Watson, 1971). However, the switching mechanism proved unreliable and the reward dispenser was operated by hand throughout the study.

An "electric pottie chair", which delivered immediate reward for sitting and for voiding, was described by Cheney in 1973. A box with a clown face painted on the front contained a 12 volt dry cell, a stepping switch, visible lights surrounding the face and in the smiling mouth, and appropriate wiring. The box stood facing the chair, and was wired to a switch on the chair leg and to two studs in the pot. When the child sat on the chair the leg switch turned on the flashing lights around the face, while voiding in the pot turned on the lights in the mouth of the clown. No data were provided on the operation of the unit, although the author reported successful training within two or three weeks with normal children as young as 17 months of age.

Passman (1975) reported the only experimental toilet training study in which reward for toilet voiding was automatically programmed. The device consisted of a bowl inserted in the toilet above water level with two semi-circular metal plates lining the bottom of the bowl, except for a 3 cm gap between the halves. Wires connected the plates through relays to a tone generator and a Lafayette M & M dispenser in front of the toilet. Urine or faeces which bridged the gap between the plates led to simultaneous delivery of the tone and an M & M into a tray at eye level. The toileting sequence was prompted and shaped using procedures described by Watson (1973a). Three profoundly retarded adults were the subjects in an ABA design with B being a reversal period when no reinforcement was delivered. All three achieved independent toileting with few voiding accidents by the end of training, with increased accidents and fewer toilet uses during the reversal period. However, the contribution of automated reward delivery was not examined.

Two final approaches to automated response detection and reinforcement delivery are worth mentioning because they are the only reports of studies which approximate the amount of control achieved in the laboratory. Reinforcement was applied directly to bowel control through operant conditioning (Engel, Nikoomanesh & Schuster, 1974; Kohlenberg, 1973). Both studies aimed to reduce involuntary soiling in normal children and adults who had impaired sphincter action which prevented the holding back of faeces, but who were otherwise in full control of their own toileting. The procedures are of particular interest because internal bowel responses were measured and reinforced directly, in contrast to the usual toilet training procedures which do not deal directly with the muscle action involved in bladder and bowel control.

Although the apparatus and procedures differed in the two studies, the general approach was similar. The pressure exerted by the anal sphincter was monitored by a balloon inserted into the rectum, so that it lay across the anal sphincter. A polygraph recorder kept a continuous record of this pressure. In the Engel et al. study the subjects were instructed to match the pressure readings usually achieved by normal people when the rectum was distended by inflating the balloon. They were reinforced by watching the polygraph tracings which gave immediate feedback concerning their success. Praise from the experimenter was initially given each time the tracing reached the normal level, but the experimenters found that this additional reinforcement was unnecessary.

All subjects achieved a normal sphincteric response to the rectal distention by the end of approximately eight hours of training spread over about twelve weeks. Further evidence of improvement was provided by long term follow-ups which indicated that, of six subjects, four never soiled again, two others only soiled a little on rare occasions, and one additionally began to have normal bowel motions.

Kohlenberg's subject was a thirteen-year-old boy who had soiled all his life and who had been treated surgically for Hirschprung's disease but unsuccessfully. The balloon assembly in this study was filled with red tinted water which extended from the balloon through clear plastic tubing. The other end of the tube was placed vertically next to a scale, and the height of the water column against the scale served as visual feedback of the relative changes in sphincteric pressure. The child was instructed to keep the water level above a predetermined level (one rarely achieved during baseline). However, this visual feedback only resulted in pressure at criterion level for a short time at the beginning of each session. Additional reward was then provided by the experimenter, who dropped money into a jar for specific lengths of time during which the response stayed at or above the criterion level.

Operant control of the length of time during which criterion pressure was maintained was clearly demonstrated, with the response changing during alternating reinforcement and extinction periods and according to the schedule of reinforcement. In addition, a measure of Resting Yield Pressure before and after training indicated an improvement in sphincter muscle tone. Although soiling did not completely stop after training, it was considerably reduced.

These two studies are important because they provide the first indication that internal bowel responses can be detected directly and reinforcement can be programmed so that it is directly contingent on these responses. Few investigators interested in toilet training have attempted to develop methods which will directly control the muscle action involved in bladder and bowel control, although acquisition of these responses has been the least satisfactory. The pants alarms and reinforcement dispensers allow only indirect monitoring and strengthening of muscle action. The two studies just described suggest that methods based on biofeedback technology may provide more direct response detection and delivery of consequences.

CHAPTER 5.

THE AZRIN AND FOXX TOILET TRAINING PROGRAMME : A PILOT STUDY

5.1. INTRODUCTION

It was suggested in Chapter 3 that toileting is a complex chain of operant responses and fine discriminations which involves a great deal more than voluntary sphincter control. Separate discriminations are required with regard to environmental arrangements, clothing and its disposition on the body, and physiological sensations. In addition to these discriminations, there is a long chain of movements which must follow a fixed order.

The traditional methods employed by parents and institutions to toilet train both non-retarded children and retarded persons have not been directed towards acquisition of the whole chain. Enquiries into the circumstances have suggested that training has usually involved frequent toileting accompanied by occasional mild punishment for accidents or praise for voiding in the toilet which, however, has frequently not been administered in any systematic fashion. The responses and discriminations in the chain have usually been acquired in a similarly unsystematic manner, although the results have frequently been satisfactory with non-retarded children. However, such unsystematic procedures have not proven to be successful for many retarded persons, who often fail to acquire not only bladder and bowel control, but also many of the other skills involved in toileting.

There is some evidence suggesting that incontinent retarded persons can achieve a degree of bladder and bowel control when consequences are made contingent on toilet voiding and voiding accidents (Ando, 1977; Barrett, 1969; Hundziak, Maurer & Watson, 1971; Waye & Melnyr, 1973; Wolf, Risley, Johnston, Harris & Allen, 1967). However, many of the subjects trained with these procedures continued to have some accidents at the end of training, few learned to carry out the entire toileting sequence, and some were not influenced by the procedures at all. Furthermore, the improvement that did occur often required a number of months of training before it was achieved (Colwell, 1969; Dayan, 1964; Hundziak et al., 1971; Kimbrell, Luckey, Barbuto & Love, 1967; Levine & Elliott, 1970; Spencer, Temerlin & Trousdale, 1968; Thompson & Grabowski, 1972; Yoder, 1966).

The most impressive results with retarded persons have been achieved by more complex programmes of training which have attempted to teach the entire sequence of skills involved in toileting (Azrin, 1973; Azrin, Bugle & O'Brien, 1971; Azrin & Foxx, 1971; Bensberg, Colwell & Cassel, 1965; Giles & Wolf, 1966; Mahoney, Van Wagenen & Meyerson, 1971; Van Wagenen, Meyerson, Kerr & Mahoney, 1969). Indeed, Azrin and Foxx (1971) reported that their subjects took four days on average to become self-toileting and only a few weeks to transfer their new skills to the natural environment. However, no evidence has yet been provided that all the procedures employed in these programmes are theoretically essential, and there has been no investigation of how each procedure affects acquisition. Moreover, only one study has considered whether training of the entire sequence resulted in the continued use of skills after training had ceased (Van Wagenen et al., 1969), although the follow-up in this study was hardly satisfactory, consisting of a telephone conversation one to six months after training with one parent of each subject.

In the light of the above discussion it was therefore decided to examine the effects of three training strategies commonly used in the more complex toilet training programmes. Since Azrin and Foxx have provided a complete description of their procedures in a manual (Foxx & Azrin, 1973b), their programme was selected as the basis for the study. This chapter describes the results of a preliminary study with eight retarded persons at Strathmont Centre. The aims of this study were, firstly, to examine whether the procedures would induce self-toileting in retarded persons selected to provide a range of individual characteristics and, secondly, whether any toileting skills acquired during training would be maintained over an extended period of time. These aims were selected with the intention of extending knowledge about the effectiveness of the programme, since Azrin and Foxx have provided little information about the characteristics of their subjects and no information concerning the long-term effects of training. In addition, it was anticipated that the pilot study would provide the author and training staff with practical experience in using the programme, and enable procedures to be devised for recording and for handling any problems that arose.

5.2. METHOD

Four trainers, including the author, participated in the programme. The first trainee was trained by the author. All four trainers were involved thereafter, with each trainer working with each trainee for a part of every day. Trainees were introduced gradually into the unit until the trainers were working with four trainees at a time.

5.2.1. Subjects

Trainees were selected to represent a wide range of individual characteristics, as shown in Table 5.1. No trainee had organic conditions considered likely to interfere with the achievement of continence (see Chapter 2).

TABLE 5.1. Individual characteristics of eight residents trained with the Azrin and Foxx toilet training programme.

SUBJECT	SEX	AGE (years)	LEVEL OF RETARDATION	LENGTH OF RESIDENCE WITHIN AN INSTITUTION	CLINICAL DIAGNOSIS AND SPECIAL CHARACTERISTICS	MEDICATION
1	M	50	severe	45 years	Unknown cause. Has had tuberculosis. Hydrocele (removed since training). Placid.	Diazepam
2	F	49	severe	30 years	Unknown cause. Evidence of lower motor neurone lesions and a number of minor strokes suspected. Resistive. Tears clothing.	Thioridazine, valium, haloperidol, benzotropine
3	M	18	profound	9 years	Unknown cause. Colostomy. Metabolic disorder (episodes of severe iron deficiency). History of biting and scratching.	Haloperidol, benzotropine
4	M	19	profound	12 years	Down's syndrome. Extremely passive and withdrawn.	None
5	M	7	moderate	3 years	Down's syndrome. Ventricular septal defect.	None
6	M	20	profound	3 years	Unknown cause. Thyroid hyposecretion suspected. History of extreme obesity.	Thyroxine, thioridazine
7	F	13	severe	3 years	Post cerebral venous thrombosis at 9 months. Epileptic. Quadraplegic cerebral palsy. Mildly abnormal E.E.G.	Phenytoin, phenobarbitone
8	M	12	severe	6 years	Birth trauma (anoxia). Believed to be epileptic. Gross generalised abnormal E.E.G. Physically uncoordinated.	None

5.2.2. Setting, Equipment and Materials

The first two trainees were trained in their living units, but away from other residents. All other trainees were trained in a unit made available for the duration of the studies based on the Azrin and Foxx programme. The floor plan of this unit is shown in Appendix 5.1.

During training, each trainee wore a pants alarm and each toilet was fitted with a toilet alarm, following Foxx and Azrin (1973b). The alarm was mounted in a metal box approximately 6.5 cm x 6.5 cm x 2 cm. The electronic circuit for the alarm is shown in Appendix 5.2. It was powered by two 1.5 volt torch batteries. When the alarm was used to detect voiding accidents, it was placed in a canvas cover which was pinned to the back of the waist band of training pants. Leads extended from the alarm to the crotch of the pants, where the ends were clipped on to two studs. [See Plate 5.1.]

PLATE 5.1. The alarms connected to the bowl and training pants.

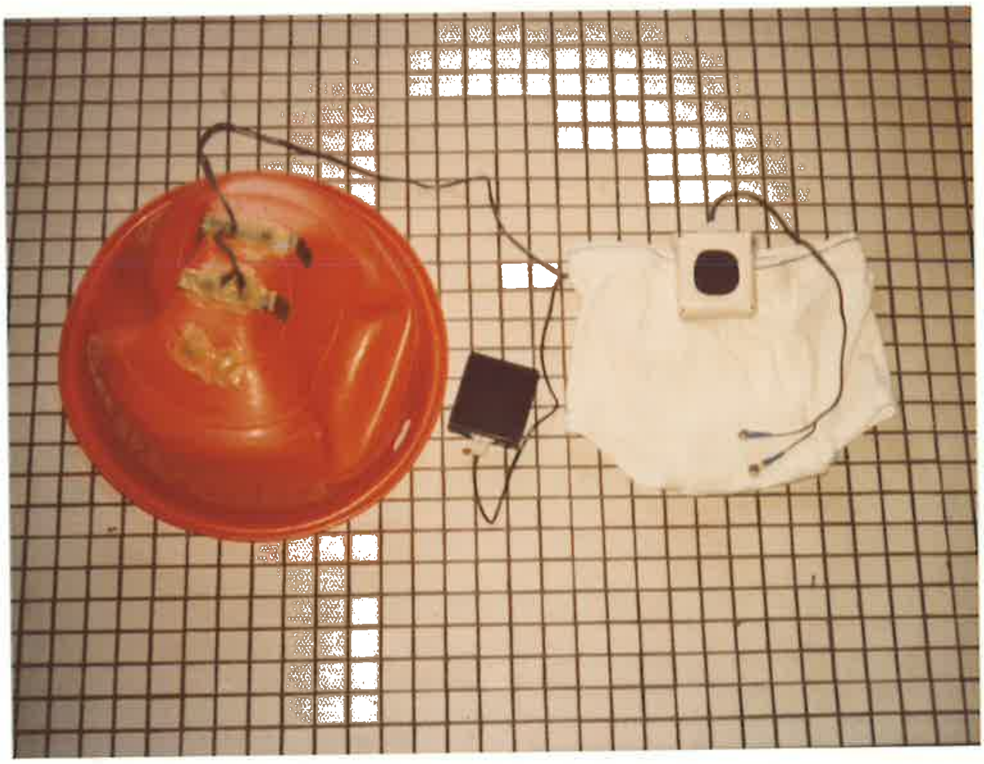


PLATE 5.2. The toilet alarm and bowl in place in the toilet.

When the alarm was used to detect toilet voiding it was placed on a stand behind the toilet with the leads extending to the underside of a bowl placed in the toilet. The lead ends were soldered into two screws attached through the bowl to two metal plates in the floor of the bowl. [See Plates 5.1 and 5.2.]

Both the studs in the pants and the metal plates in the bowl were separated by a gap of 1.5 cm which, when bridged by urine or faeces, sounded a discontinuous tone alarm. The alarm was set to deliver a high-pitched tone when it was attached to training pants, and a low-pitched tone when it was attached to the bowl. Other materials used during training included a clock with a second hand, a kitchen timer, a variety of rewards previously established as desirable to the trainees concerned, drinks and drinking mugs, and cleaning and laundry equipment.

5.2.3. Staff Training and Organization

This is an aspect of training programmes which is rarely described but which could have a considerable effect on results. Four trainers were involved throughout the study. One was the author; the other three were recruited from volunteers in the nursing department. They remained as trainers throughout this study and the experiment described in Chapter 6. Each trainer took part in the toilet training programme on a regular basis each day, and each took responsibility for particular organizational aspects of the programme. The author was responsible for overall planning and the establishment of the programme, including selection of trainees, staff training and supervision of maintenance programmes in the living units following training. The Charge Nurse was responsible for supplies, liaison with the Nursing Department, day-to-day attendance of trainees and supervision of the staff roster. The Staff Nurse took responsibility for the maintenance and servicing of equipment, and for the preparation of the training area, while the Nursing Aide was responsible for cleaning and laundry.

Trainer training consisted of a three-day workshop based on the Foxx and Azrin manual (1973b), and involved guided reading, lectures, discussion groups, short answer quizzes, and a videotaped demonstration of each step in the toilet training programme. During this period an informal, enthusiastic and friendly atmosphere was established; support was constantly available and all problems were dealt with immediately.

5.2.4. Toilet training procedures

These followed Foxx and Azrin (1973b). Training took place from 9.00 a.m. until 5.00 p.m. every week day. No training was given during weekends. General training conditions involved the trainee sitting close to the toilet and away from other staff and residents, although there was considerable interaction with trainers. The trainee was dressed in a jacket and training pants with the alarm attached. The toilet was fitted with the bowl and toilet alarm. Training continued until at least nine out of ten successive voidings were self-initiated in the toilet, or for twenty days, whichever came first, and consisted of two stages as follows:

(i) Bladder and bowel training. This stage involved the trainee experiencing a half-hour schedule of training. A variety of drinks were first offered until the trainee had drunk as much as he or she wanted, up to four cups. One minute later a prompt was given to go to the toilet consisting of a touch, a gesture and a simple verbal direction. Each step of toileting was prompted in this way with sufficient time allowed for the trainee to respond voluntarily. When necessary the trainee's hands and body were gently guided through the required movements until correct responding began to occur voluntarily, at which point enthusiastic praise was given. As the tasks became initiated in response to prompts alone, additional guidance and praise were gradually reduced until they were no longer required.

The trainee sat on the toilet until voiding occurred (indicated by the toilet alarm) or for a maximum of 20 minutes. A large reward was given with enthusiastic physical and verbal praise for toilet voiding. The same procedures of prompting and guidance were used to elicit standing from the toilet, pulling pants up, and flushing the toilet. Thereafter, trainees were rewarded for dry pants with a small food reward and praise every five minutes until the next half-hour schedule was due. Voiding accidents in the pants (indicated by the pants alarm) resulted in an over-correction procedure consisting of admonition, withdrawal of rewards and drink, and required that the trainee then wipe up the mess and practice the toileting sequence until the next half-hour schedule was due.

(ii) Self-initiation training. After the first time the trainee had independently completed the toileting procedure and successfully voided in the toilet, the half-hour schedule ceased. Drinks were then offered following toilet use and no further prompts to go to the toilet were given. After each successive self-initiation, the trainee's chair was moved about two feet further away from the toilet, rewards for dry pants occurred less frequently, and drinks and rewards for toilet use were made increasingly intermittent (see Appendix 6.5). Any accident activating the pants alarm resulted in admonition, withdrawal of rewards and drinks, mopping up for 15 minutes, then six practice trials of the toileting procedure. If three consecutive voidings were accidents or a full training day passed with no voiding, the trainee was returned to bladder and bowl training.

Maintenance. Training ceased when at least 9 out of 10 successive voidings had been self-initiated in the toilet, at which time the trainee was returned to his or her normal environment without the alarms. Primary care staff then carried out a generalization programme under the supervision of the author and the other three training staff. Rewards for toileting had been phased out completely by this time. Rewards for dry pants were scheduled before meals, snacks and bedtime, with others given unsystematically at the discretion of the primary care staff. These staff members continued recording each reward and all voiding accidents, the latter being treated as they had been during self-initiation training. Following an accident, the next meal, snack or bedtime was delayed for an hour. This procedure continued until the trainee went for 14 days with no accidents, or for six months, which ever came first, at which time staff were congratulated, thanked, and asked to refrain from intervening further with the trainee's toileting, so that all intervention was withdrawn.

These maintenance procedures were not provided for those trainees who had not achieved the required number of self-initiated toiletings by the end of the allotted training time. Instead, staff in the living units were informed of the skills that the trainee had demonstrated during training and were asked to encourage the continued use of these skills during toileting.

<u>Follow-up procedures</u> after a period of 8 to 11 months following the withdrawal of maintenance. Training staff spent eight hours a day for three days observing the voiding and toileting behaviour of each trainee. The trainee was checked covertly for dry pants at least every hour and all accidents were recorded. In addition, observations of all toiletings were recorded using the check list shown in Appendix 5.3.

At random intervals, a second observer, not acquainted with the status of the trainees, independently made records as a check on the reliability of the follow-up observations. Reliability was calculated using the formula:

$$\frac{\text{Agreements}}{\text{Agreements} + \text{Disagreements}} \times 100$$

The independent observer attended for several hours five times during the follow-up observations. Observer agreement for voiding accidents was 100 percent and for the items on the check list of toileting performance, 71.5 percent. Disagreements were on items such as whether the subject had voided or pulled pants up successfully. These circumstances were occasionally difficult to judge without interfering with the subject.

5.3. RESULTS

One trainee (S2) will not be included in the discussion of results as her training was discontinued after five days. She was markedly resistant to the programme and proved too difficult for the trainers to manage. Of the remaining seven trainees, five achieved the training criterion and progressed to the maintenance phase (see Table 5.2). Two trainees (S4 and S8) occasionally toileted themselves during training, but this was accompanied by an increase in the frequency of voiding accidents (see Figures 5.1 and 5.2). Trainee 4 began to self-initiate frequently during the last few days, and it was thought that he might achieve the training criterion with additional training. However, a further 20 days of training resulted in no improvement. In fact, more voiding accidents were occurring at the end of this period than had occurred during the first week of training (see Figure 5.2). This subject was therefore returned to his usual activities, and staff continued to direct him to the toilet as they had before training.

The frequency of accidents decreased throughout training and maintenance for the five successfull trainees (i.e., Subjects 1, 3, 5, 6 and 7), four of whom achieved 14 consecutive, accident-free days two to ten weeks after maintenance had begun (see Figures 5.1 and 5.2). One trainee (S3) continued to toilet himself regularly during maintenance, but had one or two accidents a week until the procedures were withdrawn at the end of six months. However, this was a considerable improvement on his performance before training (see Table 5.2).

Progress through training was not always smooth. Only two trainees (S5 and S6) continued to self-initiate regularly after their first attempt (see Table 5.2). The remaining trainees toileted themselves once or twice and then had three voiding accidents in a row. This resulted in a return to

TABLE 5.2. Comparison of toileting performance before training and 8 to 11 months after training.

SUBJECT	TOILETING BEFORE TRAINING	DAYS IN TRAINING	NUMBER OF RETURNS TO BLADDER-TRAINING	DAYS IN MAINTENANCE	TOILETING AT FOLLOW-UP
1	No attempt to toilet self. Often wet, never dirty. Occasional toilet use when taken.	11	1	45	Toilets self 3 or more times a day. Rarely wet or dirty. Occasional toilet use on the infrequent times staff sent him.
2	No attempt to toilet self. Frequently wet and dirty. Smears faeces. Rare toilet use when taken.	5 (training discontinued)	-	None	Not assessed.
3	No attempt to toilet self. Often wet. Will cooperate when taken, but toilet use only reported twice in several years (colostomy).	16	2	180 (did not reach criterion)	Toielts self 4 or more times a day, but often without voiding. Wets once every few days or weeks. Often sent to toilet, when he often voids.
4	No attempt to toilet self. Rarely wet or dirty. Often uses toilet when taken.	40 (did not reach criterion)	4	None	No attempt to toilet self. Never wet or dirty. Usually voids when sent.
5	No attempt to toilet self. Frequently wet, sometimes dirty. Occasional toilet use when taken.	6	None	70	Toilets self 3 or more times a day, occasionally without voiding. Wet once every day or two. Sometimes voids on the frequent times he is sent.
6	No attempt to toilet self. Frequently wet or dirty. Occasional toilet use when taken.	3	None	14	Toilets self 6 or more times a day, but often to masturbate only. Never wet or dirty. Toilet use on rare times he is sent.
7	No attempt to toilet self. Frequently wet or dirty. Rare toilet use when taken. Will not sit willingly.	5	1	21	Toilets self 2 to 3 times a day, but rarely voids. Wet or dirty twice or more a day. Occasional toilet use when sent. Sits willingly.
8	No attempt to toilet self. Frequently wet or dirty. Some toilet use when sent. Occasional faeces or urine smearing.	20 (did not reach criterion)	1	None	Toilets self up to 5 or 6 times a day and usually voids. Wet or dirty once every few days or weeks. Sometimes voids when sent. No smearing.

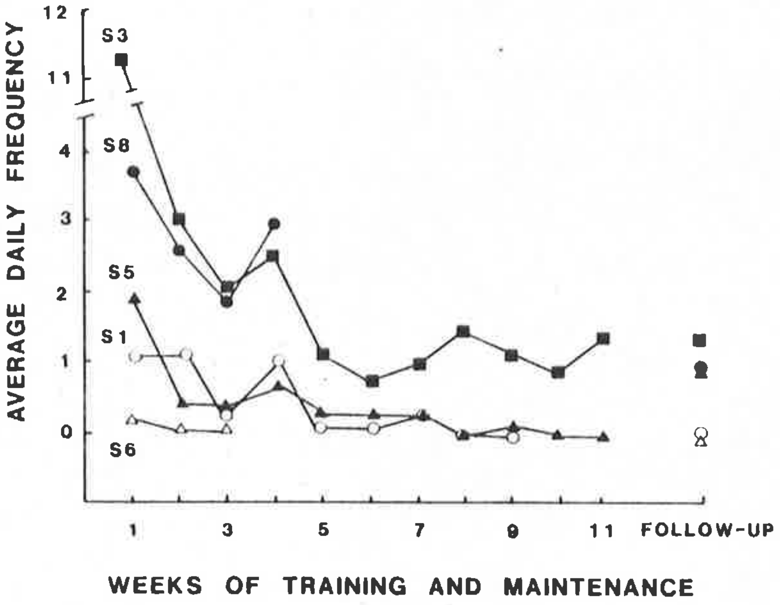


FIGURE 5.1. Average daily frequency of voiding accidents for five trainees in whom intensive training produced increases in toileting skills as measured 8 to 11 months after training. (Follow-up frequencies are averaged over three days).

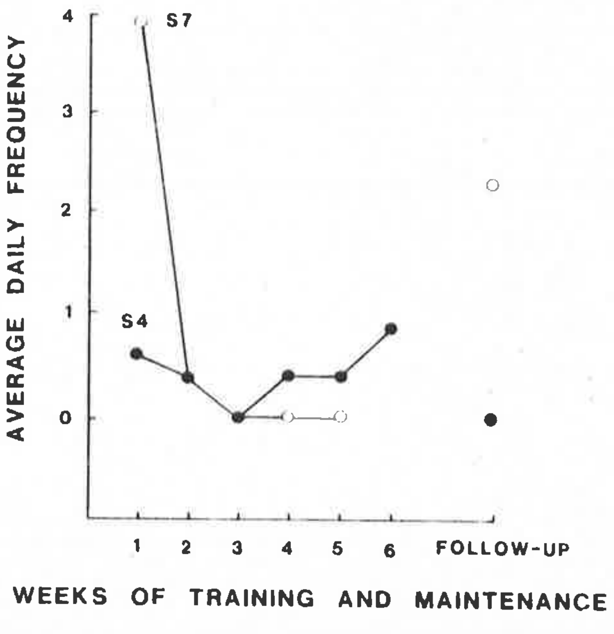


FIGURE 5.2. Average daily frequency of voiding accidents for two trainees in whom intensive training produced little increase in toileting skills as measured 8 to 11 months after training. (Follow-up frequencies are averaged over three days).

bladder and bowel training. One trainee (S3) returned to this stage of training twice before he began to toilet himself regularly. The trainee who was given additional training (S4) returned to bladder and bowel training four times. On two occasions this occurred because he did not void for the entire eight hour training day.

At follow-up, five trainees were consistently toileting themselves with no more than one accident a day (see Figure 5.1). This group included one boy (S8) who previously had not reached the training criterion and who had not therefore entered the maintenance phase of training. Self-toileting in all five cases had been maintained, despite the fact that these trainees were also directed to the toilet by staff on some occasions. One trainee who entered but did not complete the maintenance phase of training (S3) was sent to the toilet frequently by staff, but still toileted himself two or three times a day.

Two trainees were considered to have made little progress at follow-up in comparison with their pre-training performance (Figure 5.2). One (S4) made no attempt to toilet himself, although he had no accidents during the follow-up period. This was the trainee who had failed to become self-toileting even with additional training. The other (S7) had reached the training criterion in five days and the maintenance criterion in three weeks (see Table 5.2). However, at follow-up she had several accidents a day and voiding rarely occurred in the toilet, although she often toileted herself.

Performance in each of the toileting tasks which were not directly related to bladder and bowel control was also observed. In addition, any occurrences of inappropriate behaviour during toileting were noted. Each of these tasks are dealt with separately in the sections which follow.

Dealing with clothing. All but S4 attempted to pull their pants down and up during toileting with varying degrees of success. To be successful the pants had to be clear of the toilet seat and near the knees when down. Both under and outer garments had to be replaced to near the waist when up, although tucking in was not expected. During the follow-up period, S1 always successfully pulled his pants down, while other trainees were at least 50 percent successful. Three trainees (S1, S3 and S7) usually pulled their pants down in the correct fashion before sitting on the toilet, but often walked out of the toilet area without pulling their pants up.

Sitting on the toilet. Although many retarded persons do not place themselves on the toilet in such a way that all the elimination is contained, only two trainees (S5 and S8) had problems seating themselves during follow-up. Both were small boys who appeared to have trouble balancing at the right angle to direct urine into the toilet, although S5 often used a pot and had no problems with it. S3 very occasionally misdirected urine. Otherwise all trainees sat themselves on the toilet appropriately.

Standing after toilet voiding. Some retarded persons often stand up from the toilet without taking account of whether voiding has finished. Others sit for long periods until taken off the toilet by a member of staff. Five trainees in this study rose appropriately after toilet voiding had finished. S4 made no attempt to stand by himself, and S8 was often helped to stand after remaining seated for a long period. Staff reported that S8 only did this during follow-up observations, and not during the normal routine immediately before and after that period.

Flushing the toilet. This was the task with which trainees had least success. Only one (S5) flushed the toilet at all, and this only four times during the follow-up period.

Inappropriate behaviour. Only three instances of such behaviour were observed at follow-up. S4 rocked while seated on the toilet, a behaviour he exhibited frequently in all settings. S6 and S7 both put a hand in the toilet once. There was no sign of unwillingness to sit by S7 or of smearing by S8, although both of these trainees exhibited these problems before training.

5.4. DISCUSSION

Azrin and Foxx used their procedures to bring about successful self-toileting in nine retarded adults at Anna State Hospital, Illinois (1971). The study reported here attempted to replicate and extend their findings to both retarded children and adults in a South Australian institution. It demonstrated that the training procedures could be used by regular staff after a short period of training, and that the maintenance procedures could be incorporated into the normal routines within the institution.

However, the success rate in this study did not match that reported by Azrin and Foxx. All nine of their trainees achieved the training criterion in one to fourteen days and took four to eighteen weeks to achieve two accident-free weeks on the ward. In the study reported here, two trainees had not achieved the training criterion after twenty days of training in one case and forty days in the other. In addition, one trainee who reached criterion during training was still having approximately one accident a day after six months of maintenance.

Individual trainees showed marked variability in their reactions to the programme. S2 proved so resistant that her training was discontinued. Her method of resistance was to tear her pants, smear faeces and force urination at frequent intervals. This pattern might have been detected by detailed observation beforehand, although ward staff indicated that, although she often tore clothing, she was usually quiet and withdrawn in the normal living environment. It may be that her difficult behaviour was a specific reaction to intensive training and could not have been predicted from behaviour on the ward. Experience with this trainee confirmed Foxx and Azrin's suggestion (1973b) that the programme is unsuitable for persons who display serious behaviour problems.

The failure of two other trainees to become self-toileting during training further suggests that the procedures may not be effective for some retarded persons without serious behaviour problems. One unsuccessful trainee was profoundly retarded, withdrawn and passive. He took little notice of things around him and rarely moved unless the trainer physically guided him. This was typical of his behaviour in other settings. The other unsuccessful trainee was severely retarded and had an abnormal EEG and mild quadriplegic cerebral palsy. Both of these trainees were more handicapped than those trained by Azrin and Foxx (1971). Further research is required in order to establish whether other similarly severely handicapped persons can become self-toileting with the Azrin and Foxx procedures.

However there was evidence of some learning in both of these severe cases. Although, according to staff, neither trainee had self-initiated toileting before training, both toileted themselves on a number of occasions during training. In addition, one toileted himself regularly during follow-up. This suggests that the Azrin and Foxx procedures were partially successful with these two trainees. It is possible that modification of the procedures to allow more gradual acquisition and considerably more practice in each of the skills required would have increased the degree of success with these trainees.

Some problems were experienced by successful trainees during training. Nearly all trainees showed some signs of resisting direction during the first few days of training. For instance, S1 vomitted a number of times during training and his fluid intake was reduced. He showed other signs of passively resisting the programme and this may have been one of them. S3 initially reacted badly to the procedures which followed voiding accidents. He had previously undergone a number of behaviour management programmes prior to toilet training. These considerably reduced his scratching and biting, extending his attention span and providing him with some simple manipulation and locomotor skills. However, during the first few days of training, he responded to the overcorrection procedure with scratching, biting, self-hitting and crying, although this behaviour disappeared completely by the end of training without any special measures being taken by the trainers, and he began to initiate much more positive interaction with staff. Both of these changes were maintained over eight months.

The same trainee (S3) also frequently confused the sequence of responses during training and still showed this tendency during the follow-up period. In addition, five of the seven trainees stopped toileting themselves and reverted to having frequent accidents soon after they began self-initiating. This resulted in their return to bladder training until they were self-initiating again. A similar tendency to relapse has also been noted by Smith, Britten, Johnson and Thomas (1975). These authors attempted to prevent relapses by continuing bladder training until trainees had self-initiated a number of times. This procedure may be more effective than the abrupt transition from one training phase to another used by Azrin and Foxx.

Despite these problems, nearly all trainees made some improvement in their toileting skills during training, with the majority becoming self-toileting. However, quite clearly the aim of toilet training is not only to bring about correct performance during training, but also to provide trainees with skills which they will then continue to use in their daily lives. To this time there is no firm evidence available concerning long-term maintenance. Azrin and Foxx (1971) did record the frequency of accidents for all nine of their trainees over a five month period after training. However, two trainees were on the maintenance programme for the entire period, and the remaining seven were only free of systematic intervention for two to three months. Consequently, these data cannot be considered as evidence for long-term use of toileting skills after cessation of training. Furthermore, Azrin and Foxx did not present evidence to show that all the skills involved in toileting were maintained.

The study reported here provides some data relevant to the question of long-term maintenance, in that an assessment was made of the level and range of toileting skills which each trainee displayed eight to eleven months after all intervention had been withdrawn. At follow-up all trainees were using at least some of the toileting skills that they had learned during training, and all trainees but one were having fewer accidents than before training. However, few had maintained the level of skill displayed at the end of training. Only three were totally accident-free during the three days of follow-up observations, and one of these had not completed training to criterion, so that it is unlikely that training was the only factor which contributed to his improvement. Generally, sitting on and standing from the toilet were the skills which were consistently performed well by all trainees at follow-up. Six trainees failed to pull their pants down correctly on some occasions, although these errors usually involved incorrect positioning of the pants, so that pants were not clear of the toilet seat, rather than a failure to pull pants down at all. The skills which were least well performed at follow-up were pulling pants up and toilet flushing, the latter occurring only rarely.

To some extent the loss of toileting skills following training and prior to follow-up may have resulted from a general staff practice of assisting residents with toileting. It was noted that during the three-day observation period every trainee was directed to the toilet by staff on some occasions, and verbal or physical help was often given during toileting, even when the trainee was clearly performing correctly. Under these circumstances, the improved continence and successful self-toileting which was observed says much for the effectiveness of the training procedures. It would also seem necessary that, before introducing a toilet training programme into an institutional setting on a large scale, adequate training in maintenance procedures be provided for all staff involved in general supervision and care.

Two important questions are raised by the results of this study which particularly relate to the complexity of the procedures used. One question concerns the practical issue of effectiveness. The Azrin and Foxx programme incorporates a number of procedures designed to facilitate both skill acquisition and generalization to the natural environment. However, although the programme led to self-toileting in a range of retarded persons, neither complete mastery nor adequate generalization was achieved in all cases. It is possible, therefore, that effectiveness could be improved by procedural modifications. Two studies have introduced such modifications (Singh, 1976; Smith et al., 1975), but have not provided evidence that their procedures were any more effective than those achieved with the original procedures.

The second issue raised by the present results concerns component analysis and its contribution to theoretical advancement. It has been argued that the process of programme design should be guided by research which isolates the effects of the different components in a particular training package, replaces those components which contribute little to the outcome variance with new procedures, and then compares the outcomes of the original and the modified programmes (Berger, 1975; Kiernan, 1975). This kind of evaluation can also suggest answers to the theoretical question raised by this study concerning the nature of the learning processes involved in the acquisition of toileting skills. For example, was the learning which occurred during training primarily due to associations built up by frequent practice (Logan, 1971), to the direct strengthening of stimulus-response associations through the provision of rewards and punishments (Skinner, 1953), or was it largely due to informational feedback provided by the physical guidance, the alarms and the structured nature of the programme itself (Estes, 1971)? Which processes are involved may be revealed at least partially by examining how performance is affected by variations in procedure. These questions are addressed in the studies which follow in Chapters 6, 7 and 8.

CHAPTER 6.

STUDY 1: CONTINGENT CONSEQUENCES, GUIDANCE, AND RESPONSE DETECTING ALARMS IN THE TOILET TRAINING OF RETARDED CHILDREN USING THE AZRIN AND FOXX PROGRAMME

6.1. INTRODUCTION

Many human skills involve complex sequences of non-arbitrary responses. Self-toileting is one such skill, which many retarded persons do not learn without systematic training. The application of contingent consequences to establish and strengthen toileting behaviour in the retarded has had only limited success, as indicated in Chapter 3. The most successful training programmes have been those employing a number of training procedures. The experimental studies reviewed in Chapter 4 showed that the contingency of consequences is a necessary factor in the strengthening of low rate unitary responses or response classes. However, whether it is similarly important in the acquisition of complex, non-arbitrary behaviour sequences has not been investigated. Moreover, its contribution when a number of training procedures besides contingent consequences are used has not been established.

One of the most commonly used procedures in toilet training, besides contingent consequences, has been guidance for the associated sensory-motor skills. The evidence for the effectiveness of guidance in sensory-motor skill learning was reviewed in Chapter 4. It was postulated in that Chapter that the learning of sensory-motor skills by either young or severely retarded persons may be enhanced particularly by the motor-tactile assistance in orienting and the organization of responses which guidance can give. Certainly guidance proved as effective as knowledge of results in simple human motor learning (Holding, 1959; Holding & Macrae, 1964; Lincoln, 1956). If knowledge of results functioned as positive reinforcement in these studies, then further questions are raised concerning the relative efficacy of contingent consequences and guidance in relation to motor learning in general. There is no evidence concerning the relative importance of the two procedures in toilet training, or the possible interaction effects which may be involved.

Another major strategy used in the training of self-toileting involves response-detecting alarms to increase the trainer's accuracy of response detection and delivery of consequences. It was shown in Chapter 4 that any advantage that these alarms may confer is slight (Madsen et al., 1969; Wright, 1975). However, their effects were confounded in these studies by other procedures which varied systematically with the presence or absence of alarms. It has not been shown that the alarms alone enhance the efficacy of toilet training. It was also pointed out in that Chapter that such devices may have quite complex direct effects on bowel and bladder control, besides increasing the accuracy of the trainer (Smith, 1979). Therefore, experimental study of the role of response detecting alarms may tell us more than just whether the devices are cost-effective methodological improvements.

These three training strategies (contingent consequences, guidance, and alarms) were investigated in the study reported in this Chapter. It was decided to carry out this investigation using an existing toilet training programme which incorporated all three strategies. Two such programmes have been reported in the literature (Azrin & Foxx, 1971; Mahoney, Van Wagenen & Meyerson, 1971). The Azrin and Foxx programme was chosen for several reasons. A successful replication of their procedures with a group of retarded persons appeared when this study was being planned (Smith, Britton, Johnson & Thomas, 1975). In addition, the pilot study reported in

Chapter 5 provided further evidence that the programme was effective in inducing self-toileting. The Mahoney *et al.* procedures, on the other hand, had only been replicated with one child by another investigator who made considerable modifications to the original procedures (Litrownik, 1974). Moreover, the way in which the alarms were incorporated into the Azrin and Foxx programme allowed their contribution to be studied without altering the other procedures, whereas this was not possible in the Mahoney *et al.* programme (see Chapter 4). Azrin and Foxx also published a detailed manual of their procedures (Foxx & Azrin, 1973b), whereas the procedural description in the Mahoney *et al.* paper was much less specific.

Both contingent positive reinforcement for toilet voiding and remaining dry between toiletings, and contingent aversive consequences for voiding accidents were used by Azrin and Foxx. Several investigators have reported a failure to reduce accidents with positive reinforcement alone, even though toileting performance improved (Barrett, 1969; Hundziak, Maurer & Watson, 1971; Watson, 1968). Successful toileting involves the absence of accidents. Moreover, the occurrence of accidents is incompatible with voiding in the toilet and therefore may hamper the acquisition of self-toileting. The value of combining contingent aversive consequences to suppress unwanted incompatible responses, with positive reinforcement for the alternative desired response was discussed in Chapter 4. In the light of that discussion it was decided to treat the two forms of consequence as a single contingency package in this study, since their effects were likely to be interdependent. The hypothesis was that this combined contingency would considerably enhance the success of toilet training, but would be most effective when used together with guidance and the alarms.

The guidance used by Azrin and Foxx closely approximated the most effective aspects isolated in the early research on guidance reviewed in Chapter 4. For instance, the combination of prompts and graduated guidance for the sensory-motor tasks associated with toileting forced both perceptual orienting and movements in exactly the ways required when the task was performed voluntarily. Thus, guidance closely matched the task requirements. In addition, the prompts were gradually faded and guidance was partial rather than full, thus allowing voluntary movement. Moreover, the resistance placed in the way of incorrect movements differentiated incorrect from correct performance. It was therefore hypothesized that the guidance used in the Azrin and Foxx programme would have a major effect on the acquisition of self-toileting. However, Azrin and Foxx only guided toilet approach, pants up and down, and toilet flushing. In the study reported here, sitting and remaining seated on the toilet during toileting, and standing up from the toilet at the appropriate times were also guided, since some trainees in the pilot study reported in Chapter 5 did not initially perform these tasks without help.

Both pants and toilet alarms were used in the Azrin and Foxx programme. They were used only to ensure that trainers detected voiding when it occurred and thus delivered the appropriate consequences immediately. However, as was suggested earlier, alarms may also have a direct effect on bladder and bowel control. Since their sounding followed immediately on the onset of voiding in the Azrin and Foxx programme and was closely followed by reward or punishment, they signalled the appearance of reward or punishment and may therefore have acquired secondary reinforcing and aversive characteristics. In this capacity they may have strengthened the effectiveness of the consequences as well as increasing the accuracy of the trainers.

This is quite a different function of the alarm from the one devised by Mahoney et al. (1971), who incorporated it as a discriminative cue for going to the toilet. Alarms serving this function only marginally enhanced the efficacy of toilet training (Madsen et al., 1969; Wright, 1975). However, it was hypothesized that in the Azrin and Foxx programme the alarms would considerably enhance the effects of contingent consequences, but would be of little value when used without contingent consequences.

Many retarded persons in institutions are incontinent, and the likelihood that they will acquire toileting skills under conditions of standard care is low (Eymann, Silverstein & McLain, 1975; Eymann, Tarjan & Cassady, 1970). Those with lower general intelligence and lower initial toileting ability have the poorest prognosis (Eyman et al., 1970, 1975; Lohman, Eyman & Lask, 1967; Smith & Sanderson, 1966). In addition, there is some evidence that toileting skills are less likely to be acquired by older persons who remain incontinent (Lohman et al., 1967). Furthermore, if toileting skills have not been acquired within the first year or so of admission, they are unlikely to be acquired later (Eyman et al., 1970). It is possible that these variables also affect the likelihood that toileting skills will be acquired when training is provided. Therefore, the relationships of improvement in toileting to initial toileting ability, general intelligence, age and length of institutionalization were also investigated.

6.2. METHOD

All subjects in this study received toilet training using the basic Azrin and Foxx procedures. However, each group of children experienced a different arrangement of the three training strategies in a complete factorial design detailed in a later section.

6.2.1. Subjects

Trainees were drawn from the 303 incontinent children between four and twenty years of age resident in the institution at the time of the survey described in Chapter 2. Those having any of the medical problems, outlined in that Chapter, which were likely to interfere with toilet training, were excluded (103). The remaining children were assessed for toileting ability using the Balthazer day time toileting scale (Balthazar, 1971). Possible scores on the scale ranged from zero (no evidence of toileting) to 70 (fully independent self-toileting). Those children scoring 41 or more were also excluded from the study, since they rarely, if ever, had voiding accidents, and lost most points for failing to clean themselves after bowel motions or because they were occasionally taken to the toilet by staff. Children were also excluded if there was evidence of severe behaviour problems.

After these exclusions, 83 children remained, from whom 32 were randomly selected for this study and divided into eight groups of four. Groups were matched for pre-training toileting ability as measured by the Balthazar day time toileting scale (Balthazar, 1971), general intelligence represented by the Social Quotient (SQ) on the Vineland Social Maturity Scale (Doll, 1936), age, and length of institutionalization. SQ rather than IQ was used, as some of the children had failed to score during previous attempts at intelligence testing. Matching across groups on these four variables was considered necessary because they have been shown to be significantly related to the likelihood of becoming toilet trained (Bayley, 1973; Kushlick & Blunden, 1974; Smith & Sanderson, 1966; Tarjan et al., 1960).

Matching for toileting ability and social maturity was achieved by dividing the 83 children into those with high (21-40) and low (0-20) day time toileting scores and high (15 and above) and low (0-14) SQ. One category consisted of children with high toileting scores and high SQ. A second category had high toileting scores and low SQ. The third and fourth categories had low toileting scores and either high or low SQ. One child from each category was assigned to each of the eight groups such that group means were not significantly different at the 20% level of confidence for either control variable. Membership of the groups was then adjusted where necessary to achieve the same match for age and length of institutionalization. Group means for these four variables are shown in Table 6.1.

No attempt was made to match groups for night time toileting ability. The mean scores on the Balthazar night time toileting scale appeared to vary considerably (see Table 6.1), although the differences were not statistically significant. This was probably due to the extreme variability in individual scores within each group. An attempt was made to allocate two females and two males to each group, although sex has not proved to be related to the development of self-toileting (Tarjan et al., 1960, 1961). Group matching on this variable proved to be impossible, since the matching requirements for the other four variables had virtually exhausted the pool of suitable children. Diagnosis, aetiology, additional problems and ongoing treatment for each of the 32 children are shown in Appendix 6.1.

6.2.2. Setting and trainers

Training was carried out in the unit used for the pilot study (Chapter 5). Each child attended the unit from 8.30 a.m. until 4.30 p.m. each weekday during training. During the remainder of each day and during weekends the children took part in the normal activities of the institution with no special procedures for toileting or for voiding accidents. The maintenance programme after training was carried out in each child's normal living unit, classroom, and in any other activity areas attended as part of the daily routine.

TABLE 6.1. Distribution of pre-training day and night scores on the Balthazar toileting scale, Social Quotient (SQ) on the Vineland Social Maturity Scale, age, and length of institutionalization.

GROUP	MEAN DAY TIME BALTHAZAR SCORES	MEAN NIGHT TIME BALTHAZAR SCORES	MEAN SQ	MEAN AGE	MEAN LENGTH OF INSTITUTIONALIZATION
1	21.50	13.75	14.63	12.67	6.27
2	16.00	5.00	16.85	10.75	5.42
3	20.00	15.50	16.38	11.36	6.71
4	24.50	12.50	26.15	13.23	3.61
5	19.00	9.75	13.55	13.27	7.35
6	21.00	4.00	20.10	13.29	7.21
7	23.00	14.00	17.58	10.71	4.52
8	21.25	17.00	18.18	13.42	7.63
All Groups	20.78	11.44	17.93	12.34	6.09

Note: Differences between groups on these variables were not significant using one-way analysis of variance.

The four trainers who worked with the children were those involved in the pilot study described in Chapter 5. Each trainer worked with one child at a time. However, the four trainers were rotated so that they each worked with each child for a part of each training day, in order to control for trainer variables. Positive trainer expectations for each group of children were ensured as much as possible by presenting all training strategies as being likely to succeed because of the intensive nature of the programme. In addition, the author initially allocated children to each group using a number to designate each child so that all four trainers were kept in ignorance of the characteristics of each child as much as possible.

6.2.3. Design

A three-way complete factorial design with four possible covariates was used. The three factors consisted of the presence or absence of the three training strategies discussed above, namely, contingent consequences, guidance, and contingent alarms. Each factor had two levels, the training strategy, and the corresponding control procedure as described below. Thus, the eight groups each received a different combination of the three factors, as shown in Table 6.2.

TABLE 6.2. Arrangements of two levels of the three experimental factors across groups.

GROUP	FACTOR 1		FACTOR 2		FACTOR 3	
	CONTINGENT CONSEQUENCES	NON-CONTINGENT CONSEQUENCES	GUIDANCE	NO GUIDANCE	CONTINGENT ALARMS	NON-CONTINGENT ALARMS
1	*		*		*	
2	*		*			*
3	*			*	*	
4	*			*		*
5		*	*		*	
6		*	*			*
7		*		*	*	
8		*		*		*

* Indicates presence of the feature described by the column heading.

Contingent consequences. Positive reinforcement was delivered immediately bowel and/or bladder voiding occurred in the toilet, and after every five minutes during which pants remained dry between toiletings. Reinforcement was in the form of food, an activity or toy. The reinforcers used were those which had been demonstrated before training to be effective reinforcers for each subject when performing simple sensori-motor tasks, together with social praise and physical contact. Reinforcement was continuous until the first successful self-initiation occurred, after which it became increasingly intermittent. In addition, mild punishment was immediately contingent on bowel and/or bladder voiding which was not in the toilet. Punishment was in the form of a reprimand, withdrawal of reinforcement, cleaning up the mess, and practising toileting a number of times.

Non-contingent consequences. The control procedure for contingent consequences consisted of rewards and aversive conditions delivered non-contingently. The procedure was selected so as to ensure that the number of rewards or aversive events at each stage of training were similar for all groups and only the response contingency was varied. On the first day of training the children in the control condition received, evenly spread throughout the day, the mean number of rewards and punishments which were received during the first day of training by the corresponding group in the contingent consequences condition. Thereafter, the number of rewards and punishments received by each child was determined by the number of toilet voidings, five minute intervals between toiletings on which no voiding accident or punishment had occurred, and voiding accidents for that child during the previous training day. These rewards and punishments were distributed evenly throughout the day, so that no response-reinforcer or response-punishment pairings occurred. If a punishment was scheduled during toileting, it was delayed until toileting was completed. The purpose of this control condition was to determine the importance of the contingency, rather than the number, of supposed reinforcers.

A comment is in order concerning the ethics of using non-contingent aversive conditions. These were mild and involved no more than a reprimand and being required to carry out tasks which were not self-initiated. This was a common experience for all the children in their everyday lives. Only one trainee in the pilot study showed signs of distress during these procedures. This took the form of biting, scratching and grizzling. However, he displayed this behaviour when required to perform most tasks, including the toileting tasks, although he became increasingly compliant once he had experienced each procedure a number of times. In the study reported here care was taken to select children who did not display any similar behaviour problems. It was therefore concluded that the mildly aversive procedures would be unlikely to cause distress, whether they occurred contingently or non-contingently.

Guidance. Each of the tasks associated with toileting were prompted by the trainer. The tasks consisted of toilet approach, pulling pants down, sitting on the toilet, rising from the toilet, pulling pants up, and flushing the toilet. If performance of the task was not voluntarily initiated, or ceased part way through, the trainer physically guided the appropriate movements until voluntary performance occurred. Social praise was given during guidance for any attempt at voluntary performance until it was completely self-initiated. If the task was completed without guidance, the prompt was reduced at the next trial. This fading of prompts continued until the subject voluntarily initiated and completed the task with no prompting or physical guidance.

<u>No Guidance.</u> In the control procedure for guidance, each of the six tasks which were not involved in bladder or bowel control was prompted, as in the guidance condition, but no guidance ensued. The prompt was discontinued after the first self-initiated, correct performance of the task. If an incorrect movement occurred, or the task was not performed, or performance ceased part way through, the task was done for the child by the trainer. Praise was given when the trainer was helping the child, rather than when performance was voluntary as in the guidance condition. There was no fading of prompts or graduated guidance under the control procedure.

The purpose of this control condition was to provide a contrast with the systematic guidance, by not using fading, graduated guidance or praise for voluntary performance. It was considered inappropriate to include a "null" guidance condition without any assistance, since assistance was often given in the normal institutional setting in any case. Moreover, the operation of contingent consequences could not be assessed without some form of assistance with the associated tasks, since some of the children made no attempt to carry them out before training.

<u>Contingent alarms.</u> An alarm was attached to each subject's pants and to each toilet (see Chapter 5). A few drops of urine or a small amount of faeces elicited a high pitched discontinuous tone from the pants alarm, and a low pitched discontinuous tone from the toilet alarm. The alarm was disconnected after a few seconds so that the tone ceased. During training, the pants alarm sounded on every voiding outside the toilet, and the toilet alarm sounded on every voiding in the toilet.

Non-contingent alarms. In this condition the training pants, the bowl, and the alarm boxes used in the alarms condition were in place, so that only their use varied and not their inclusion in the setting. The alarms were not connected, and therefore did not sound when urine or faeces touched the studs. Instead, the leads were taped to the alarm boxes, and the alarms were sounded when the trainer touched the two studs at the lead ends together by hand. On the first day of training, the children heard the mean number of pants and toilet alarms which were heard by the corresponding group in the alarms condition. Thereafter, the number of times the pants and toilet alarms were sounded for each child was determined by the number of voiding accidents and toilet voidings for that child during the previous training day. The alarm soundings were distributed evenly throughout the day so that no response-alarm pairings occurred. However, trainers received no assistance in detecting voiding.

The purpose of this control condition was to determine the importance of the alarms as both response detectors and cues for the children, but with the effect of merely hearing the alarms noncontingently controlled. It was hoped to achieve this by disconnecting the alarms as detection aids for the trainers. At the same time, the relationship between the alarms and voiding was removed for the children while ensuring that it was the cue function which was varied, rather than just the occurrence of the alarm tones unrelated to voiding.

6.2.4. Control Variables

Four control variables were involved in this study. They were scores on the Balthazar day time toileting scale, SQ, age, and length of institutionalization (see Section 6.2.1 in this Chapter). These variables were used to match groups as closely as possible because of their relationship with the development of continence, as discussed earlier. However, matching was not perfect, so that variation within groups occurred. Therefore, the control variables were also examined as potential covariates. However, they were introduced in the final analyses only if they proved to have a significant covariance effect.

6.2.5. Measures

Accident rate has generally been the sole measure reported in the toilet training literature, although several studies have used additional measures such as the frequency of toilet voiding or the frequency of self-initiated toileting (see Chapter 3). Accident rate has not always proved an adequate indicator of toileting performance. For instance, two papers reported improved toileting with no accompanying decrease in accident rate (Hundziak et al., 1971; Watson, 1968). Furthermore, since toileting involves a number of responses which are performed in sequence, measures which reflect only part of the sequence will not necessarily adequately reflect toileting skill.

A further consideration in selecting an adequate measure of toileting was the environment in which performance was assessed. In most toileting studies, as in many applied behavioural studies, the most telling indicator of effectiveness is found during the final training sessions. If the procedures are effective, the behaviour of interest is by this stage occurring at close to the required rate. However, during most of the Azrin and Foxx toilet training programme, the half-hourly drinks and toileting trials elicit extremely high rates of voiding and toileting. Since two of the pilot subjects were still at this stage when training ceased (see Chapter 5), it was considered likely that high rates of voiding and toileting would still be occurring during the final training days in some cases in this study, while in those cases where the criterion was reached, these responses would have returned to more normal rates. It is likely that the forcing of high voiding and toileting rates temporarily effects performance of the different elements in the toileting sequence. For instance, half-hourly toileting may result in the "catching" of many more voidings in the toilet than would occur when toileting was less frequent, thus inflating the rate of toilet voiding. For this reason it was considered necessary to assess end of training performance after the training procedures had been withdrawn rather than during the final training sessions.

The Balthazar toileting scale was therefore used, since it fulfilled the two requirements discussed above. It provided a composite toileting score, based on a number of the skills involved in self-toileting, and scores could be obtained relatively easily in non-training environments. This scale is part of Section I of the Balthazar Adaptive Behaviour Scales (Balthazar, 1971) which provide measures of both day time and night time toileting, dressing and feeding. The scales can be used separately, and were designed to evaluate changes in each skill which may result from detailed training programmes.

The day time toileting scale included items concerning the proportion of bladder and bowel voidings which were accidents or which occurred in the toilet and were the result of either direction by others or were self-initiated. It also contained items indicating the proportion of toiletings during which pants up and down, and self-cleaning after bowel motions were performed without help, as well as how often the child let others know when a voiding accident had occurred. Scores for each child on this scale were obtained during a structured interview with a member of the direct care staff who had worked closely with the child for at least one month immediately prior to the interview.

Night time toileting was also assessed, using the Balthazar night time toileting scale. It contained items indicating the proportion of nights during which the child wet the bed, remained dry and unsoiled, and was awakened to go to the toilet. Scores for each child on this scale were obtained from a member of the night staff who had worked in the child's unit for at least one month immediately prior to the assessment.

Scores on these two scales were obtained for each child during the week before training, 30 days after training, and again 210 days (seven months) after training, and were based on estimates of average performance over the preceding month. Thus, the pre-training scores represented performance during one month before training. The post-training scores represented performance during the month following training. In the case of children who had reached the training criterion, the maintenance procedures were in force during at least some of that time. The follow-up score represented performance during the seventh month after training. Follow-up was timed so that scores for all children would be based on performance after the maintenance procedures had been withdrawn. However, several children were not able to be assessed. Follow-up toileting scores were not obtained for one child who had died several weeks before the follow-up assessment. In addition, night time scores could not be obtained for two children after training and at follow-up because no member of staff was available who had worked in these children's units for more than a few days during the previous month.

6.2.6. Interviewers for the Balthazar scale assessments

The pre-training toileting scales were administered by the author who had little or no knowledge of the children's toileting performance or other abilities and problems before training. However, both the post-training and follow-up interviews were administered by four independent interviewers who were unaware of both the children's performance during training and maintenance, and the experimental design. They were also unaware of the pre-training scores.

The interviewers were trained in the design and use of the scale. They were given the three handbooks to read (Balthazar, 1971) and attended sessions during which procedures and problems were discussed. The author then carried out several assessments observed by the interviewers, and these assessments were discussed. Each interviewer then assessed several children who had not been subjects of this study. These children were selected to enable each interviewer to experience obtaining high, intermediate and low scores on the scales. The author observed each interview, recorded scores indepently, and afterwards discussed the interview and scoring with the interviewer. This process continued until each interviewer had administered one scale on which he or she and the author obtained the same scores on all items, with no disagreements concerning the interview technique.

Reliability checks by independent interviewers were not possible, since it was often the case that only one member of the direct care staff had the required knowledge of the child. This was because of the frequent staff changes resulting from transfers, leave, and absence due to illness or attendance at staff training weeks. It was therefore considered that a second interview with the same member of staff to assess reliability would involve an interviewee practice effect which may have interfered with a true assessment of interviewer reliability. However, it was accepted that the careful training procedures would result in high reliability, especially since Balthazar reported an interviewer reliability coefficient of $r = .937$ (Balthazar, 1971) for trained interviewers.

6.2.7. Procedure in detail

The order in which the eight groups were trained was determined using a table of random numbers, with adjustments to ensure that groups receiving contingent rewards and punishment or alarms preceded the corresponding groups receiving non-contingent rewards and punishment or alarms. This was necessary because the records of the first training day from the former groups were used to determine the first day's rewards and punishments, or pants and toilet alarms for the latter groups, as stated above. The four children in each group were trained together.

Pre-training procedures. Children attended the training unit for three days before training to familiarize them with the trainers and the setting. During this time effective rewards were determined for each child. This was done by presenting the child with a simple task unrelated to toilet training which had only been partly mastered. The task was presented during several short sessions a day and a range of potential rewards were tested during task training to assess their effectiveness as reinforcers. The rewards which proved effective included chips, dried fruit, chocolate, paper to tear, a favourite toy and string. Sitting for five minutes and wearing the pants alarms were shaped when necessary. In addition, specific behaviour management procedures were designed to control any behaviour which would interfere with the toilet training procedures.

Training Procedures. The basic toilet training programme for all groups was that used in the pilot study (Chapter 5), and closely followed the programme designed by Foxx and Azrin (1973b). Each child sat in front of the toilet, received drinks every half hour followed by toileting. During toileting, each child remained on the toilet until voiding occurred, or for 20 minutes if voiding did not occur. In between toileting trials, the pants were checked every five minutes. After the first self-initiated toileting, the half-hour schedule ceased and drinks were offered after each self-initiated toileting. The pants checks and drinks were systematically faded, and the child was gradually moved further from the toilet.

However, for each group, the rewards and punishments, the alarms, and the procedures for training toilet approach, pants up and down, sitting on and standing up from the toilet, and toilet flushing were arranged as described in Section 6.2.3 of this Chapter. Thus, groups received either contingent or non-contingent rewards and punishments, guidance or no guidance, and contingent or non-contingent alarms. In the groups receiving non-contingent rewards and punishments the pants were checked and changed after accidents with as little interaction with the child as possible.

Training continued for 28 days five days a week, or until at least nine out of ten consecutive voidings were self-initiated in the toilet, whichever came first. Children who achieved the training criterion within the 28 days were placed on a maintenance programme in their normal environments. Those who did not reach criterion returned to their normal activities without the maintenance programme.

Maintenance Procedures. The maintenance procedures for all groups were those described by Foxx and Azrin (1973b) and used during the pilot study (Chapter 5). Praise was given when a pants check revealed that the child was dry and unsoiled. Since most checks preceded meals, snacks, and bedtime, these regular events also acted as rewards. Delay for an hour of a meal or bedtime, or withholding a snack altogether resulted if the pants were found wet or soiled. No reward was given for toilet use, but the punishment in use at the end of training was continued for voiding accidents.

It was not possible or advisable to arrange non-contingent rewards or punishments during maintenance, since the direct care staff were not in a position to schedule these reliably. Moreover, undeserved punishment, no matter how mild, was actively discouraged in the institution, and it was considered unethical to attempt it outside the controlled experimental environment.

Direct care staff and teachers carried out the procedures and the recording. The trainers demonstrated the procedures and prompted the staff during the first three maintenance days. Thereafter they visited every day or two to check the records and discuss procedure. In addition, they could be called to assist whenever difficulties arose. The maintenance procedures continued until 14 consecutive days with no voiding accidents occurred or, failing this, for 180 days.

6.3. RESULTS

The results of this study are presented in two sections. Scores on the Balthazar toileting scales following training are considered first, while behavioural changes during training itself are considered in a later section.

6.3.1. Analyses of improvement following training

Statistical evaluation was conducted on the mean improvement in Balthazar day time and night time toileting scores after training and at follow-up when compared with scores before training. Mean scores on these two measures before and after training and at follow-up for each group are shown in Table 6.3, and mean improvement scores are shown in Table 6.4.

TABLE 6.3. Group and overall means before and after training and at follow-up on the Balthazar day time and night time toileting scales.

GROUP	MEAN BALTHAZAR DAY TIME SCORES			MEAN BALTHAZAR NIGHT TIME SCORES		
	BEFORE TRAINING	AFTER TRAINING	AT FOLLOW-UP	BEFORE TRAINING	AFTER TRAINING	AT FOLLOW-UP
1	21.50	31.25	21.75	13.75	14.00	20.33[a]
2	16.00	28.75	31.67[a]	6.67	8.33[a]	9.00[b]
3	20.00	20.50	27.25	15.50	11.00	9.75
4	24.50	37.25	35.25	12.50	14.75	14.25
5	19.00	23.25	28.25	9.75	13.75	15.50
6	21.00	31.25	35.50	5.33	13.33[a]	18.25
7	23.00	25.50	20.00	14.00	12.00	17.50
8	21.25	32.00	33.50	17.00	5.50	18.00
All Groups	20.78	28.72	29.07	11.81	11.58	15.32

[a] Scores were unavailable for one trainee and therefore the mean is based on 3 trainees in these cases.

[b] Scores were unavailable for two trainees and therefore the mean is based on 2 trainees in this case.

TABLE 6.4. Group and overall mean improvement after training and at follow-up on Balthazar day time and night time toileting scales.

GROUP	MEAN BALTHAZAR DAY TIME SCORES		MEAN BALTHAZAR NIGHT TIME SCORES	
	IMPROVEMENT AFTER TRAINING	IMPROVEMENT AT FOLLOW-UP	IMPROVEMENT AFTER TRAINING	IMPROVEMENT AT FOLLOW-UP
1	9.75	0.25	0.25	5.33[a]
2	12.75	10.67[a]	1.67[a]	- 1.00[b]
3	0.50	7.25	- 4.50	- 7.25
4	12.75	10.75	2.25	1.75
5	4.25	9.25	4.00	5.75
6	10.25	14.50	8.00[a]	14.25
7	2.50	- 3.00	- 2.00	3.50
8	10.75	12.25	-11.50	8.75
All Groups	7.94	7.65	- 0.23	3.89

Note: Differences were calculated in the direction such that all positive values indicate improvement.

[a] Scores were unavailable for one trainee and therefore the mean is based on 3 trainees in these cases.

[b] Scores were unavailable for two trainees and therefore the mean is based on 2 trainees in this case.

An examination of individual improvement in day time toileting after training showed that all but one group improved with training. In that group, improvement was minimal for two children and one child obtained a considerably lower score after training than before training. Nine children in other groups also either showed little or no improvement or gained lower toileting scores after training. These twelve children included four who had achieved the training criteria. There did not appear to be a systematic pattern in the distribution of non-improving children among groups (see Appendix 6.2). Thus there appeared to be a general improvement in all groups, and this is discussed further, below.

On the other hand, only four of the eight groups improved in night time toileting. Of the 32 children, 19 showed no improvement or gained lower night time toileting scores after training. Generally, improvement in the remaining 13 children was slight.

Three-way analysis of variance was carried out to examine the effects of training strategies. Where individual scores were unavailable, as described in Section 6.2.5, the group mean was inserted to maintain the balanced design. No significant relationships were found between the four control variables and improvement when they were included as covariates in the analysis. Therefore, the analysis of variance results are presented without adjustment for covariates (see Appendices 6.3 and 6.4). No significant effects of training strategies or levels were found with respect to improvement scores following training. Thus, the hypotheses that contingent reward and punishment, guidance, and contingent alarms would enhance the acquisition of self-toileting were not supported. Moreover, the mean improvement for Group 1 (the only group which experienced all three training strategies) was less than for several of the other groups (see Table 6.4), so that the three training strategies together resulted in no significant improvement relative to the other control procedures.

Did the absence of differential treatment effects indicate that the obtained improvement scores were generally little more than chance variation? This possibility was checked by testing overall mean improvement against a null-hypothesis of zero improvement. Overall improvement in day time toileting was found to be significantly better than zero ($t = 3.93$, $df = 31$, $p < .001$). Improvement in night time toileting was not significantly better than zero ($t = 0.28$, $df = 29$, n.s.). Thus, training generally resulted in significant improvement in day time toileting, but not night time toileting, irrespective of the particular combination of training strategies used.

At follow-up, a similar analysis of improvement revealed a significant effect for the contingency of alarms ($F = 4.35$, $df = 1,28$, $p < .05$) (see Appendix 6.4). However, the direction of the effect was opposite to that predicted: improvement was somewhat greater for the non-contingent (mean improvement = 12.13) than the contingent alarms groups (mean improvement = 3.44). In view of the lack of a significant effect for this training strategy immediately after training, and the length of time between training and follow-up, it is unlikely that this effect was in fact due to the non-contingency of alarms during training. This result is regarded as anomalous, but is nevertheless of value. It throws serious doubt on the relevance of theories which emphasize the role of response-reinforcement contingency in complex human learning. This point is discussed in the following section.

An examination of individual scores at follow-up showed that eight children scored at or below their pre-training level, whilst 24 children showed improvement. Scores generally varied both above and below those obtained at the end of training. A test of the overall improvement at follow-up against a null-hypothesis of zero revealed significant improvement in day time toileting ($t = 3.50$, $df = 30$, $p < .001$), but not in night time toileting ($t = 1.41$, $df = 27$, n.s.). Thus, the significant overall improvement in day time toileting found after training was generally maintained at follow-up.

Although the toileting skills displayed in the natural environment appeared to improve irrespective of the training strategies used, it is still possible that one or all of the strategies could have enhanced acquisition during training, even though such effects were not reflected in the Balthazar toileting scale. Since this measure assessed performance outside the training environment during one month after training, it is possible that any differential effects of the training strategies on acquisition during training may have been obscured by other environmental influences.

In order to test this possibility, additional measures of toileting performance were extracted from the training records and analysed. This further analysis is reported below.

6.3.2. Performance during Training.

This study was primarily concerned with the effects of training strategies on toileting performance in the natural environment after training. Consequently, measurement of changes during training was not planned. However, trainers continuously observed a number of toileting responses during training. These were recorded, along with each training procedure as it was carried out, thus providing a detailed record of what both the trainer and child did. Examples of the record sheets have been provided in Appendix 6.5. The purpose of such detailed records was to ensure that problems arising during training could be quickly identified and remedied. In addition, they enabled the trainers to monitor each other's performance and so ensure that training was consistent and accurate. As a consequence, behavioural measures could be extracted for analysis.

Toileting Measures During Training. Six measures were extracted from the records as follows:

1. number of days in training,
2. daily percentage of voidings which were accidents,
3. daily percentage of toiletings which resulted in voiding,
4. daily percentage of toilet voidings which were self-initiated,
5. estimated time taken to perform the first four toileting tasks,
6. composite ratings of independence in performing the six self-management tasks; toilet approach, pulling pants up and down, sitting on and standing from the toilet, and toilet flushing.

The first consisted of the time each child spent in training. Some children achieved the training criterion within the allotted 28 days while, for others, training ended before the criterion had been reached. It was hypothesized that each training strategy would shorten the average training time, but that training time would be shortest when the three training strategies were used together.

Records were also kept of the number of voiding accidents, the number of toiletings which resulted in voiding, the time when voiding on the toilet began, and the number of successful toiletings which were self-initiated and performed without help. From these records measures were devised of accidents, toilet voiding, time taken to initiate voiding during toileting, and successful self-initiated toileting. In addition, a rating was available of the level of prompt and amount of guidance used on the last training day for the six self-management tasks associated with toileting (see Appendix 6.12).

Most toileting studies have used the frequency of accidents as the sole or main indicator of improvement. However, the frequency of voiding varied considerably before training. Some children only voided once or twice during an eight hour day, while others voided nine or ten times. It was considered that this variation may have influenced the number of accidents children were likely to have. In order to control the contribution which voiding frequency may have made to differences in accident rate, it was therefore decided to consider accidents as a percentage of all voidings, using the following calculation:

$$\text{Accidents} = \frac{\text{Number of accidents} \times 100}{\text{Total number of voidings}}$$

For the same reason toilet voidings and self-initiated toiletings were also calculated as percentages. The calculations were made as follows:

$$\text{Toilet voiding} = \frac{\text{number of toilet voidings} \times 100}{\text{total number of voidings}} \;;$$

$$\text{Self-initiated toiletings} = \frac{\text{number of self-initiated toiletings} \times 100}{\text{total number of toilet voidings}} \;.$$

A reduction in accidents indirectly reflects improvement in the ability to recognize bladder and bowel distention and voluntarily hold back reflex voiding. The other major aspect of bladder and bowel control involves voluntarily relaxing the perineal muscles and pushing down with the abdominal muscles to start the flow of urine or to expel faeces. It was thought that decreasing time between sitting on the toilet and the onset of voiding may reflect improvement in this skill. However, although voiding onset times were recorded, the time at which the child sat down was not. Nevertheless, a rough estimate of the time to voiding onset could be gained, since every toileting which was not self-initiated began exactly on the half hour when drinks were offered, followed one minute later by toilet approach, pants down and sitting on the toilet. It could be assumed that variations in drinking time would be randomly distributed and would not alter in a systematic way as training progressed. Similarly it was assumed that the time taken to approach the toilet, pull down pants and sit would vary only slightly since these tasks appeared subjectively to take about the same amount of time with guidance, no guidance and when the child performed them competently without help. There was no time recorded for the start of a self-initiated toileting. However, children who self-initiated successfully took the few steps to the toilet, pulled their pants down and sat in a matter of seconds and invariably voided within several seconds of sitting on the toilet. It was therefore assumed that successful self-initiations resulted in almost immediate toilet voidings. The estimated time taken on the first four toileting tasks was therefore calculated by subtracting the starting time of the trial from the time of voiding onset and subtracting one minute to remove the constant time between drinks and the toilet approach prompt. Successful self-initiated toiletings were scored as zero time to voiding onset. These times were calculated only for toiletings which resulted in voiding.

Since no baseline records of the above four measures were available, improvement was assessed by taking the difference between the average daily score during the first and last quarters of training. It was hypothesized that each of the three training strategies would lead to shorter training times and greater improvement in the four behavioural measures than the corresponding control conditions.

The sixth measure was available only at the end of training. This was the amount of help provided for toilet approach, pants up and down, sitting on and standing from the toilet, and toilet flushing. The amount of help for each task during the last training day was rated on a four point scale, as follows:

1. Physical assistance for the whole task.
2. Physical assistance for part of the task.
3. Task prompted but no other assistance.
4. No prompt or physical assistance.

These ratings were combined to give a total score for independence in performance of the self-management tasks.

No formal reliability checks were made of the trainers' observations and recording, since they were not initially made for evaluation purposes. Nevertheless, it was considered that a high degree of reliability was maintained in the following ways. Generally, more than one trainer was present, and when a trainer was not involved in training he or she assisted the others and checked the records. Trainers were required to frequently check each other's observations and recording. This was done whenever possible by having one person record while the other carried out the procedures. At the end of the trial any disagreements between the two about what had occurred were resolved. In addition, trainers prompted each other if there was any uncertainty about procedure or recording. Examination of the records at the end of each day also helped to ensure recording accuracy.

6.3.3. Analyses of improvement during training

Thirteen of the 32 children completed training to criterion in the allotted time. The distribution of these children and the average time in training for each group are shown in Table 6.5.

Analysis of covariance revealed that pre-training toileting ability was significantly negatively related to the length of time in training (standardized Beta = -.47). Those with greater ability, as indicated by high scores on the

TABLE 6.5. Training time in days and number of children who completed training to criterion.

GROUP	NUMBER COMPLETING TRAINING TO CRITERION	AVERAGE TRAINING TIME IN DAYS
1	3	10.3
2	2	23.5
3	2	18.8
4	1	22.3
5	1	24.5
6	0	28.0
7	2	16.8
8	2	15.3

Balthazar day time toileting scale, were more likely to reach the training criterion, whereas those with few skills generally did not reach criterion within the allotted 28 days.

No significant relationships were found between time in training and SQ, age or length of institutionalization. Therefore, the analysis of variance results are presented without adjustment for these variables (see Appendix 6.6). The main effects were not significant, but there was a significant interaction effect for contingency and guidance. Inspection of the means in Table 6.6. shows that more children reached the training criterion earlier when either

TABLE 6.6. Mean numbers of days in training in the contingency and guidance conditions.

	CONTINGENCY	NON-CONTINGENCY
GUIDANCE	16.88	26.25
NO GUIDANCE	20.50	16.00

the two training strategies or the two corresponding control conditions were used in combination. It was considered that this interaction effect might be spurious since no logical explanation was immediately apparent, other than the possibility that either combination was easier for the trainers to operate. Puzzling interactions of this nature perhaps indicate that uncontrolled factors were more important than the experimental conditions.

Four other variables extracted from the training records allowed an analysis to be made of changes during training, since a comparison could be made between scores at the beginning and at the end of training. These variables consisted of measures of voiding accidents, toilet voidings and self-initiated toileting, and an estimate of time taken to perform the first four tasks. Although groups were not matched before training on these variables, no significant differences between group means in the first quarter of training were found.

Improvement on these four variables was calculated by taking the difference between mean scores in the first and last quarters of training as shown in Tables 6.7, 6.8, 6.9 and 6.10. Three-way analysis of variance was carried out to assess the effect of training strategies. Four control variables (Balthazar day time toileting score, SQ, age and length of institutionalization) were included as covariates only when a significant covariance was found. In fact, only one relationship between a control variable and improvement was found. Pre-training toileting ability was significantly correlated with improvement in self-initiated toileting (standardized Beta = 1.13), with those having high scores on the Balthazar day time toileting scale showing the greatest improvement (see Appendix 6.7).

TABLE 6.7. Group and overall means for percent accidents/total voidings during the first and last quarters of training, and mean improvement scores.

GROUP	FIRST QUARTER OF TRAINING	LAST QUARTER OF TRAINING	IMPROVEMENT AT THE END OF TRAINING[a]
1	19.50	23.75	- 4.25
2	36.50	24.50	12.00
3	25.50	25.00	0.50
4	20.00	34.00	-14.00
5	24.50	21.25	3.25
6	18.25	20.25	- 2.00
7	20.50	10.25	10.25[b]
8	9.50	4.50	5.00[b]
All Groups	21.78	20.44	1.34

[a] Differences were calculated in the direction such that all positive values indicate improvement.

[b] One trainee in each of these groups achieved mastery during the first quarter of training and maintained it, thus obtaining a zero improvement.

TABLE 6.8. Group and overall means for percent toilet voidings/total toiletings during the first and last quarters of training, and mean improvement scores.

GROUP	FIRST QUARTER OF TRAINING	LAST QUARTER OF TRAINING	IMPROVEMENT AT THE END OF TRAINING[a]
1	95.50	91.50	- 4.00[c]
2	73.00	82.75	9.75
3	81.00	84.75	3.75
4	88.50	84.75	- 3.75[b]
5	86.50	83.25	- 3.25[b]
6	77.25	73.25	- 4.00[b]
7	86.75	85.25	- 1.50[c]
8	68.75	76.75	8.00[c]
All Groups	82.16	82.78	0.63

[a] Differences were calculated in the direction such that all positive values indicate improvement.

[b] One trainee in each of these groups achieved mastery during the first quarter of training and maintained it, thus obtaining a zero improvement.

[c] Two trainees in each of these groups achieved mastery during the first quarter of training and maintained it, thus obtaining a zero improvement.

TABLE 6.9. Group and overall means for percent self-initiated toileting/total toilet uses during the first and last quarters of training, and mean improvement scores.

GROUP	FIRST QUARTER OF TRAINING	LAST QUARTER OF TRAINING	IMPROVEMENT AT THE END OF TRAINING[a]
1	25.25	69.50	44.25
2	22.50	44.75	22.25
3	22.25	46.25	24.00
4	1.00	43.75	42.75
5	16.50	28.25	11.75
6	7.00	7.50	0.50
7	23.00	50.00	27.00
8	10.50	50.00	39.50
All Groups	16.00	42.50	26.50

[a] Differences were calculated in the direction such that all positive values indicate improvement.

TABLE 6.10. Group and overall means for estimated time in minutes taken to perform the first four toileting tasks during the first and last quarters of training, and mean improvement scores.

GROUP	FIRST QUARTER OF TRAINING	LAST QUARTER OF TRAINING	IMPROVEMENT AT THE END OF TRAINING[a]
1	8.25	2.50	5.75
2	6.75	4.50	2.25
3	4.75	3.25	1.50
4	7.25	3.50	3.75
5	6.75	5.75	1.00
6	8.25	9.25	- 1.00
7	6.75	5.00	1.75
8	9.75	7.75	2.00
All Groups	7.31	5.19	2.12

[a] Differences were calculated in the direction such that all positive values indicate improvement.

No significant effects of training strategies on improvement in voiding accidents, toilet voiding or self-initiated toileting were found (see Appendices 6.7, 6.8, and 6.9). However, analysis of improvement in the time taken to perform the first four tasks revealed a significant main contingency effect ($F = 7.32$, $df = 1, 25$, $p < .05$), and a significant interaction effect ($F = 5.19$, $df = 1, 25$, $p < .05$) for guidance and alarms (see Appendix 6.10). Improvement was greater with contingent consequences (mean improvement = 3.31) than with non-contingent consequences (mean improvement = 0.94). The greatest improvement in time taken to perform the first four tasks occurred in Group 1 (see Table 6.10) where all strategies of training were combined.

These results probably reflect improvement in the time taken to approach the toilet, pull down pants, and sit on the toilet rather than just the efficiency with which toilet voiding was initiated, because of the way the measure was estimated. They indicate that guidance did affect the time taken to approach the toilet, pull the pants down and sit, thus complicating the measure. Nevertheless, the greatest <u>improvement</u> occurred in Group 1, which received all three training strategies. Contingent reward appeared to motivate the children to speed up their performance of the sequence of tasks which preceded that reward. The immediate delivery of contingent reinforcement was probably ensured when trainers were alerted by the sounding of the toilet alarm, thus increasing the effect on voiding onset. In addition, guidance probably led to more efficient performance of the other three tasks. Without contingent reward, the effects of the other two strategies became less clear. Similarly, withdrawing either guidance or the contingent toilet alarm also confused the picture. In fact, training without guidance or toilet alarms was more effective than using one without the other (see Table 6.11).

TABLE 6.11. Mean improvement in the estimated time in minutes taken to perform the first four toileting tasks when guidance, contingent alarms and the two corresponding control conditions were used.

	GUIDANCE	NO GUIDANCE
CONTINGENT ALARMS	3.38	1.63
NON-CONTINGENT ALARMS	0.63	2.88

These findings raised questions about the overall magnitude of changes in these four dependent variables during training. It was important to check that there was overall improvement during training grater than could be expected by chance. Overall mean improvement on each of the four variables was tested against a null hypothesis of zero change, using Student's t ratio. Improvement in self-initiated toileting scores of 26.50 was significant ($t = 4.18$, $df = 31$, $p < .001$), and estimated time taken to perform the first four toileting tasks significantly reduced by 2.12 minutes overall ($t = 4.18$, $df = 31$, $p < .001$). However, improvement in voiding accidents ($t = 0.55$, $df = 29$, n.s.) and toilet voiding ($t = 0.29$, $df = 22$, n.s.) was not significantly different from zero. Therefore, it is not surprising that no effects of control variables or training strategies were found for the latter two variables.

Examination of individual toilet voiding scores during training suggested that the failure to find improvement was due to two features of the data (see Appendix 6.12). First, there was no room for improvement in eleven cases, since they always voided when toileted from the first day of training. Second, the percentage of toiletings during which voiding occurred either remained the same or decreased by the end of training in 13 cases. These cases included two who had no unsuccessful toiletings at the beginning of training. Only 10 children improved on this measure. There appeared to be no pattern in the distribution of these cases among groups. Inspection of individual accident scores revealed that about as many children got worse as improved on this measure, with again no apparent pattern in the distribution among groups. Despite the failure to find general improvement in what would seem to be vital components of the self-toileting sequence, the majority of children (22 out of 32 available cases) were self-initiating at least some of the time at the end of training.

The sixth toileting variable considered was the amount of help required at the end of training for the six tasks associated with toileting. Each task was rated on a four point scale, giving a possible score of 24 on this variable when performance was completely independent. Group means are shown in Table 6.12. Analysis of variance on these end of training scores

TABLE 6.12. Group and overall means at the end of training for ratings of performance on the six self-management tasks.

GROUP	MEAN SCORES (maximum score = 24)
1	18.75
2	20.25
3	16.50
4	19.00
5	20.25
6	22.00
7	12.00
8	17.75
All Groups	18.31

was carried out in the same way as for the other variables. Pre-training toileting ability, as a covariate, was again found to be significantly positively related to this variable (standardized Beta = .31). In addition, there was a significant effect of guidance ($F = 5.83$, $df = 1, 27$, $p < .05$) (see Appendix 6.11). Those who received guidance performed these tasks with less help at the end of training (mean = 20.31) than those who received no guidance (mean = 16.31). However, these results must be interpreted with caution as there is no evidence concerning the amount of help required at the beginning of training.

6.3.4. Case studies

In general, the findings discussed above indicate that some essential skills involved specifically in bladder and bowel control were not affected by training strategy, and some were not improved by training with any reliability. This general conclusion is further illustrated by an examination of individual performance during training (see Appendix 6.12). Not only was there marked variability between individual responses to training, but many children varied considerably from day to day. To demonstrate this, the daily records of voiding accidents, toilet voiding and self-initiated toileting for three children are presented, since these were the variables which showed no training strategy effects.

Those children who reached criterion generally did so within two weeks, with most taking no more than five days. This was also the case in the pilot study reported in Chapter 5. Child 2 from Group 1 is typical of these children. Most children who reached criterion already had the ability to initiate voiding immediately whenever they were on the toilet. When toilet voiding failed to occur, it did so only on the rare occasions when toileting followed within a few minutes of an accident. Figure 6.1 shows that Child 2

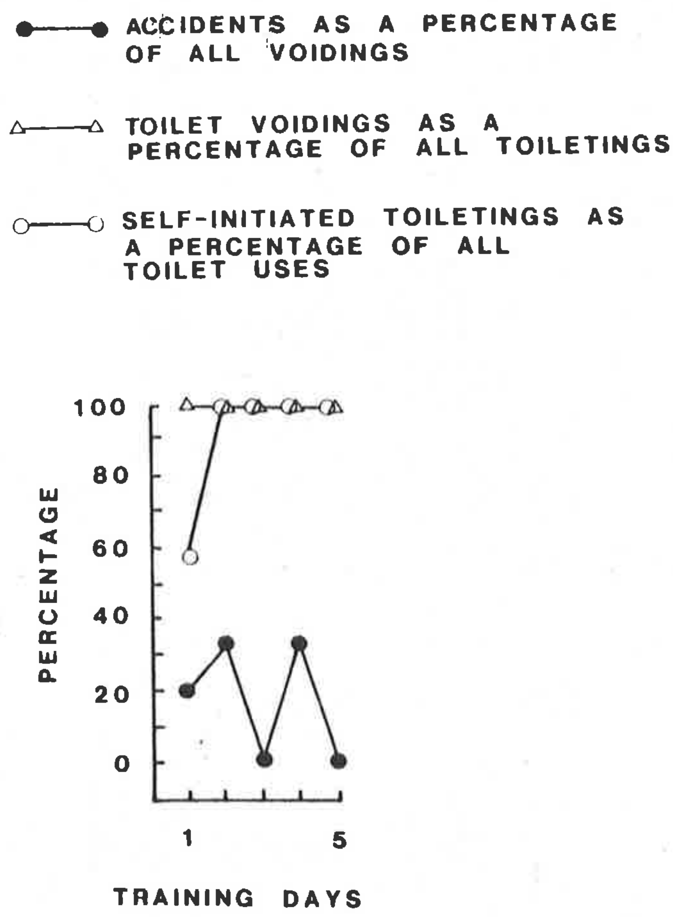


Figure 6.1. Changes in accidents, toilet voiding and self-initiated toileting for Child 2.

always voided in the toilet. She began self-initiating on the second training day and continued to do so on the third day. However, on the third day she began to have frequent accidents again and was returned to sitting in front of the toilet in preparation for bladder training. She immediately began self-initiating again, and this time managed to achieve a run of ten self-initiated toiletings without accidents. She was transferred to the maintenance phase, and reached the maintenance criterion of 14 consecutive accident-free days in 77 days. At follow-up she was reliably toileting herself, although her accident rate was higher than before training.

Rapid progress through training did not necessarily indicate that all the skills involved in self-toileting had been acquired. For example, the transition from bladder training to self-initiation training occurred immediately following the first self-initiation. This appeared to be too sudden for most children, including Child 2. Generally, children self-initiated a few more times after the first attempt, and then began having accidents in rapid succession. Although they were clearly able to carry out the toileting sequence, they were not always recognizing bladder or bowel tension as the signal to toilet themselves, or had not learned to hold back voiding so that they could get to the toilet in time. Only four children progressed smoothly through the self-initiation phase without having to return to bladder training at least once.

The structure of the self-initiation phase also gave the children little time to consolidate their skills. To complete this phase, a minimum of nine self-initiations in a row was required, with no more than one accident. Extra fluids were being offered after every toileting except the sixth and the ninth so that voiding still occurred about every half hour and sometimes more frequently (see Appendix 6.5). This meant that the self-initiation phase was often completed in half a day. Moreover, during this process, the child was moved two feet from the toilet after each self-initiation. This meant that by the sixth self-toileting the child was free to move around the unit. These environmental changes were introduced too rapidly for many children, since accidents usually began occurring again as soon as the toilet was out of sight. This was the case for Child 2.

In addition, there was no opportunity to become accustomed to self-initiating when the urge to void was occurring only two or three times a day rather than ten to fifteen times a day. This was because the extra fluids were only partially faded by the end of training. Thus the transition from training to maintenance was also too sudden for many children. Although Child 2 completed maintenance successfully, she showed no improvement on the Balthazar day time toileting scale at the end of the first month of maintenance. In fact, the number of accidents steadily increased during maintenance until the last three weeks, and she was having more accidents at follow-up than before training.

This pattern indicates that the training programme, even with all three training strategies included, was not arranged to teach reliably the skills involved in inhibiting accidents under normal toileting conditions; that is, without extra fluids and without the cues provided in the training environment, performance deteriorated. The transition between phases, and from training to the normal environment may need to be much more gradual if accident-free self-toileting is to be completely mastered.

Nine children showed no signs of improvement in accident rate or toilet voiding. Most of these rarely or never self-initiated during training, and most took over five minutes to void in the toilet, with no improvement in this skill during training. Child 3 from Group 1 was typical of this group. Her performance is shown in Figure 6.2.

Most of these children obtained low scores on the pre-training Balthazar day time toileting scale, although three were high scorers. This failure to respond to training occurred under various experimental conditions. It was suggested in Chapter 5 that failure to respond to training may occur among extremely withdrawn, profoundly retarded individuals. This suggestion is partially supported in this study, in that all five children who were profoundly retarded belonged to this group, including Child 3. It was also suggested in Chapter 5 that children with diffuse brain damage may also fail to respond to training. However, this was not supported, since, of the eight children with this problem, only three failed to improve. The remaining child in the non-improving group showed no evidence of either problem. He was in a

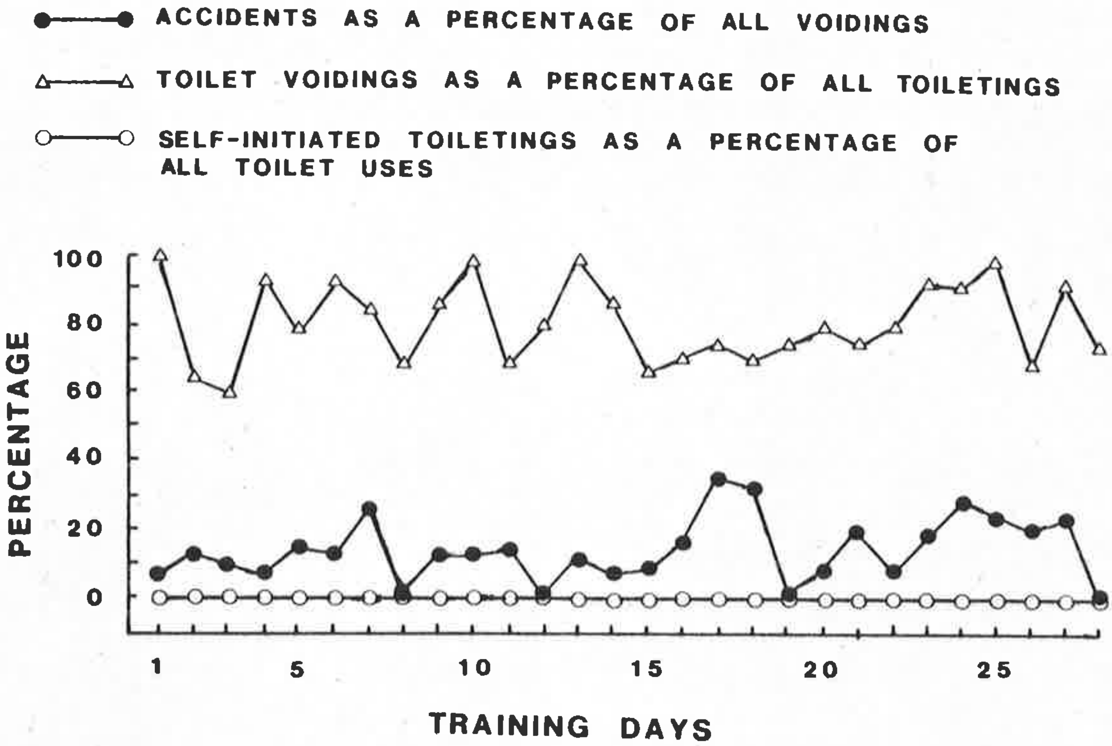


Figure 6.2. Changes in accidents, toilet voiding and self-initiated toileting for Child 3.

non-contingent group and made it quite clear that he wanted rewards whenever he finished a toileting trial. He was the only child in the study who did this, and might have improved if contingent rewards had been used.

Although the subject characteristics suggestsed above may have contributed to training failures, it was considered that some more general fault with the training programme should be sought, such as insufficient clarification of learning tasks from the trainee's point of view. It is possible that the non-improving children might have responded to step-by-step training of one task at a time with gradual transitions from one step to the next.

Child 3, like most of these children, showed no sign that she recognized when each task was required. There was also no sign that the response-reward connection was recognized, although other children in the contingency condition showed this recognition by looking for the reward as they finished the response. Nevertheless, even the non-improving children occasionally attempted to elicit rewards from the trainers at other times.

The ten remaining children improved on one or more of the four measures but did not reach criterion in the allotted time. All but one were voiding in the toilet more quickly by the end of training. This one child was in the non-contingency condition. However, the performance of this group was erratic, especially after they had begun to self-initiate. The records for Child 13 illustrate this (Figure 6.3).

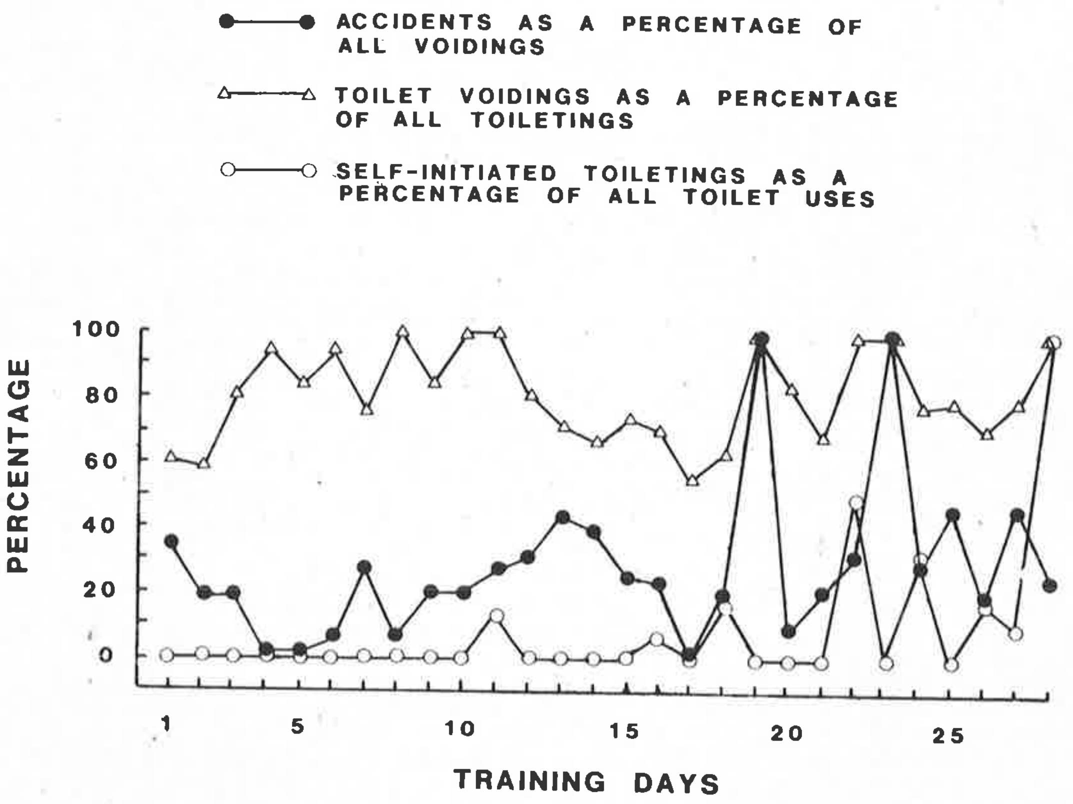


Figure 6.3. Changes in accidents, toilet voiding and self-initiated toileting for Child 13.

Inspection of this figure shows that toilet voiding steadily improved until the first attempt to self-initiate. It began to improve again as self-initiations became more frequent, but performance was erratic. There was also a slight improvement in accidents which was also disrupted when self-initiation began. The disruption was much greater than for toilet voiding, and continued during the rest of training. Child 13 did not continue to self-initiate, but began to have frequent accidents soon after bladder training was withdrawn. She was returned to self-initiation training seven times during the last 18 days of training because of relapses of this kind. However, she tended to continue self-initiating for longer periods with fewer accidents until, on the last day, every toileting was self-initiated.

It is possible that children like Child 13, who performed erratically but continued to improve, might have reached criterion with longer training. However, this erratic performance again indicates that, although the self-toileting sequence was acquired, the ability to recognize bladder and bowel tension and hold back voiding until the toilet could be reached, was not well taught under any of the experimental conditions. Re-design of the training programme in order to more effectively teach this skill may make progress for such children more certain.

6.4. DISCUSSION

The most consistent influence on improvement in toileting skills during training was the amount of toileting skill which the children already possessed before training began, as measured by the pre-training Balthazar day time toileting scale. Children with higher scores on this measure were more likely to reach the training criterion in less than the allotted 28 days. In addition, whether they completed training or not, they also showed greater improvement in self-initiated toileting and performed the self-management tasks with less help at the end of training than those with lower scores. These findings suggested that persons with greater initial toileting ability will not only show greater improvement in their toileting skills under conditions of standard care (Eyman et al., 1970), but will also respond to training better than persons with few initial toileting skills.

The one measure of performance during training on which improvement occurred irrespective of initial toileting ability was the estimated time taken to void in the toilet. As discussed earlier, this measure was an approximate estimate of the speed with which the toileting sequence was carried out prior to the delivery of the major reward rather than a precise measure of voiding speed. As such, it yielded complex effects which may have overshadowed the clear relationship between initial toileting ability and improvement found in the other measures. In addition, improvement in toileting ability as measured after training and at follow-up were unaffected by initial toileting ability. These measures probably reflected how well toileting skills were maintained in the natural environment as well as how much improvement occurred as a result of training. It is possible that the factors which affect skill maintenance are quite different from those which influence acquisition. Bladder and bowel control, as reflected in the measures of voiding accidents and toilet voiding, did not improve significantly during training and therefore possible influences on the acquisition of these skills could not be determined.

It was thought that SQ, age, and length of institutionalization would also influence how well children learned during training, but evidence for such influences was not found. The failure to find any influence of length of institutionalization on improvement in toileting is understandable, since earlier evidence for this was in relation to conditions of standard care (Eyman et al., 1970). The longer individuals remained untoilet trained, the less likely they were to improve without special training. The provision of intensive toilet training probably overrides this trend.

The evidence for a specific relationship between social and chronological age and reduction in accidents during toilet training with the Azrin and Foxx programme (Smith & Smith, 1977) was not confirmed, and no significant improvement in this skill was found in this study. It is surprising that these two variables were unrelated to improvement generally, as indicated by length of time in training, the measure of self-initiated toileting and performance after training. However, the age range and length of training were both greater in the Smith and Smith study. Their oldest trainee was 56 years of age and they provided ten weeks of training, whereas the oldest trainee in this study was 20 years of age, and training ceased after 28 days. It is possible that the restricted age range and restricted training time in the present study prevented relationships which would otherwise occur. Furthermore, measures of toileting skill after training may be unaffected by these variables for the same reason as was suggested in relation to initial toileting ability.

Although individual children may respond to training differently, one would expect that most would acquire some skills as a result of training and that some training strategies would be more effective than others. The differential effects of several training strategies on skill acquisition may appear in a number of aspects of performance during training. The superiority of one training strategy over another may be reflected in decreased training time, a greater number of trainees completing training in a given time, greater improvement in performance during training, or improved performance after training. Improvement in performance may be reflected in decreasing response times, increasing independence in task performance, or an increasing tendency to produce the response in the appropriate circumstances. It was expected that all three training strategies investigated in this study would be more effective than the control conditions with which they were compared. However, the obtained effects were quite complex, and raised important questions concerning the methods used in applying the training strategies, as well as the general programme design.

The contingency of rewards and punishments appeared to have no effect on improvement in performance of the entire toileting sequence, as reflected in training time and the measure of self-initiated toileting. However, when contingent consequences were used in conjunction with guidance and contingent alarms, more children completed training within a few days. Contingency did affect improvement in the performance of the first part of the sequence. This was reflected in the measure of time taken to perform the first four toileting tasks. If we consider that the major contingent reward occurred following the onset of voiding rather than at the end of the entire toileting sequence, this finding suggests that it did strengthen at least one aspect of that part of the sequence to which it was directly applied.

In the same way, guidance was directed at the specific skills of toilet approach, pants up and down, sitting on and standing from the toilet, and toilet flushing, and these were the tasks which predictably were performed less well when no guidance was provided. Although no measure of improvement was available for these tasks, the amount of independence in their performance on the last training day was significantly greater in the groups receiving guidance. The finding that guidance contributed to improvement in the first part of the toileting sequence adds weight to this finding, since this measure partly reflected improvement in the speed with which toilet approach, pants down and sitting were performed.

The sounding of the toilet alarm to signal the onset of voiding also contributed to improvement in the speed of performance of the first part of the sequence. However, the contribution of both the toilet alarm and guidance was complicated by the fact that the measure which reflected their combined effects was a composite measure of four tasks to which different training strategies were applied. It appears that, when training strategies did have an effect, they were quite specific to the tasks to which they were applied. Separate measures of improvement in each task may have revealed the specific effects of guidance and contingent alarms more clearly. The issue of measurement of toileting performance will be taken up again at the end of this section.

The failure to find either training strategy effects or overall improvement for voiding accidents and toilet voiding was unexpected, since the inhibition of voiding away from the toilet and voluntarily bringing about voiding during toileting are primary skills in toileting. Although some children improved, performance actually deteriorated in many cases, no matter which training strategies were used. This suggests that neither structured toileting nor any of the three training strategies reliably enhanced acquisition of these particular skills.

To summarise, guidance appeared to enhance acquisition of self-management skills, and contingent consequences increased the speed with which those tasks preceding them were performed. Guidance and contingent alarms also contributed to this increase in performance speed; but the way in which they contributed was not clear because several skills were incorporated in the measure which displayed this effect, and each skill may have been affected differently by the two strategies. The primary skills of bladder and bowel control were not reliably taught by either frequent structured toileting or the training strategies. Even when the full programme incorporating the three training strategies was used, both in this study and the pilot study reported in Chapter 5, some skills did not improve and some trainees made little or no progress. Nevertheless, nineteen children in this study began to toilet themselves during training. Moreover, the majority of the 32 children were found to have improved on their pre-training toileting skills when assessed in their natural environments one month after training and again seven months later, although some regression was noted at this last assessment.

No significant improvement was found in night time toileting. Since day time rather than night time toileting was the target of training, this provides some evidence that improvement was a direct result of the training programme. However, improvement occurred irrespective of the training strategies used. This suggests that other aspects of the procedures may have been more important than the three training strategies which were studied. These procedures included increased fluids, regular frequent toileting, and keeping each child in sight of the toilet while reducing other competing stimuli to a minimum. Smith (1979) suggested that the exact nature of training procedures may be irrelevant and the obtained data support his suggestion. The structured framework provided by intensive toilet training programmes may be the crucial feature leading to the acquisition of toileting skills.

6.5. IMPLICATIONS OF THE STUDY FOR THE DEVELOPMENT OF IMPROVED TRAINING PROGRAMMES

The full training programme devised by Azrin and Foxx (1971) was replicated with seven trainees in the pilot study and four in Group 1 of this study, giving a total of 11 replicating cases. All nine of Azrin and Foxx's trainees achieved the training criterion within four weeks, with a marked reduction in accident frequency. In this replication, eight children achieved the criterion, but three failed to achieve it within four weeks. One of the three had still not reached it after additional training was given. In addition, the proportion of voidings which were accidents increased rather than decreased by the end of training for two trainees in Group 1, even though they were toileting themselves frequently enough to achieve the training criterion. Thus, the success rate reported by Azrin and Foxx was not matched in this replication. Moreover, aspects of training which Azrin and Foxx regarded as crucial were found to have only limited importance.

A possible explanation for the lower success rate in the present studies lies in the evidence found of greater improvement among children who had more toileting skills before training. Azrin and Foxx did not assess pre-training toileting ability. However, they recorded an average accident rate before training of approximately two per day. In our study most children were having five or more accidents a day before training, and some never voided in the toilet. This suggests that Azrin and Foxx's trainees had more ability to hold back voiding than many of the trainees in this study and may have also had more toileting ability generally. They were therefore more likely to succeed during training than many of the trainees in this study.

Perhaps trainees needed to have some previously acquired toileting skills in order for the Azrin and Foxx procedures to bring about accident-free self-toileting, and some of these essential skills were not adequately taught as part of the procedures. The results of this study suggest that bladder and bowel control skills were those which were least likely to be brought under voluntary control. Since Azrin and Foxx derived many of their procedures from operant learning principles, it may be that an operant analysis of toileting is insufficient. However, experience with the procedures here suggests that the problem arose from an incomplete behavioural analysis rather than from failure of the principles underlying the analysis.

The particular punishment procedures which were made contingent on accidents appeared to be generally ineffective. Singh (1976) omitted them altogether and still successfully trained a severely retarded child with a simplified version of the Azrin and Foxx programme, to the point where the child was toileting himself with no accidents. Some trainees in this study actually enjoyed the "punishment" procedures, which could therefore hardly be functioning as punishment. Smith and his colleagues reported similar experiences (Smith, 1979; Smith et al., 1975). They modified the punishment procedure as a result. They also found, as was found in this study, that trainees tended to relapse once they were left to toilet themselves during self-initiation training. This indicated that the transition from bladder training to self-initiation training after the first self-initiation did not allow the new skills to stabilize. To overcome this problem they faded the prompts more gradually and delayed self-initiation training until trainees had toileted themselves successfully a number of times. These observations and the present results prompted the writer to re-analyse the training procedures outlined in the Foxx and Azrin manual (Foxx & Azrin, 1973b), with outcomes described below.

In Chapter 3, self-toileting was described as a chain containing a number of sequential response elements linked by environmental cues, which act as both discriminative stimuli and conditioned reinforcers. This was represented in Figure 3.1, and the reader may wish to refer to that figure during the following analysis.

The toileting chain may be expanded to include further responses and linking cues. For instance, R_2 in Figure 6.4(a), the pants up response, can be further broken down as shown in part (b) of the same figure.

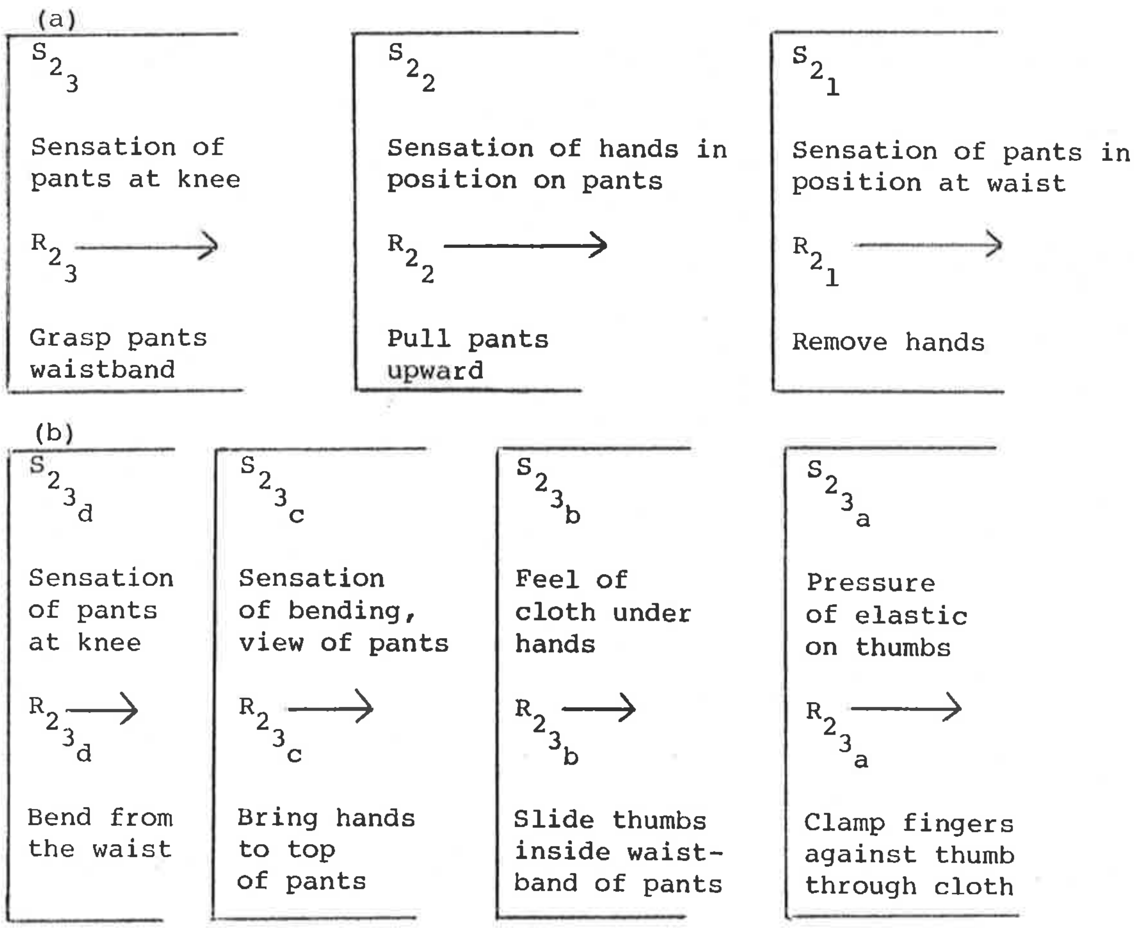


Figure 6.4. Expansion of the pants up response in the self-toileting sequence.

Conceptually, the actual number of toileting responses and linking stimuli which can be represented is arbitrary and can be expanded or contracted at will. However, the detail with which responses are broken down may be crucial to successful learning. The problems which many retarded persons have in acquiring the self-toileting sequence often result from training programmes which require the performance of multiple responses which do not exist as whole units in the person's behaviour repertoire. Learning cannot take place if the responses in the chain are contracted such that they are too complex and unlikely to be performed. For instance, teaching the expanded pants up chain represented in Figure 6.4(a), may allow an individual to carry out the task so that it can be strengthened, although the same individual may not be able to perform if presented with the pants up task as a single unit. Further breakdown of this task, as in Figure 6.4(b), may be necessary for another person who is unable to grasp the waistband ($R2_3$).

Nor can learning occur if the individual cannot discriminate the stimulus situation which signals the response required to advance the sequence to the next stimulus situation. The linking stimuli which occur naturally in the chain may not themselves be discriminable by an individual. They may also vary so much from time to time that the individual cannot generalise, and the response may therefore not come under environmental control. One method of overcoming this problem is to pair a constant, easily discriminable stimulus with the naturally occurring linking stimuli. The added stimulus can be gradually withdrawn as generalization to the natural stimuli occurs. This method may also bring the natural stimuli into perceptual range for discrimination.

The Azrin and Foxx toilet training programme was not based on a full analysis of this chain of responses and linking stimuli. The toileting sequence itself was presented as a single unit rather than as a chain, the elements of which could be strengthened one at a time. Training was broken into two main phases. On every trial during the first bladder training phase the individual was required to complete the entire sequence. The tasks were not added one at a time from back to front, as occurs in the typical chaining of compex responses (Millenson & Leslie, 1979). However, few individuals had all the elements of the chain in their repertoire, and were therefore unlikely to perform correctly if left to respond voluntarily. In addition, the training environment was relatively uncontrolled, so that an indeterminate number of irrelevant responses were possible. Consequently, acquisition of the elements could not be achieved by successive approximations in the normal way. Prompts and graduated guidance were used instead as a means of eliciting and moulding the correct response so that it could be strengthened. However, this procedure was not enough for the trainees who did not improve. For instance, some individuals had not previously acquired even the basic skills required in pulling pants up and down. They did not put any effort into hooking fingers or thumbs into the pants cloth, they did not maintain a grasp on the cloth when moving the hands up or down, or they failed to adjust hand position when an obstracle such as the buttocks impeded the movement of the pants. These persons might have acquired the pants up and down responses if these had been expanded to include further discrete elements, a procedure which was not included in the Azrin and Foxx programme. Hence some children in the guidance condition in this study were still requiring prompts and guidance at the end of training.

In addition, not all the elements of self-toileting were included in the sequence for training. On every trial during the first bladder training phase the learner went through the entire toileting sequence, as defined in the programme. This occurred every half hour during training. Consequently, the naturally occurring stimulus of bladder or bowel tension was not systematically established as the signal for the learner to run through the toileting sequence, even though it is the essential signal for most toileting. Although the likelihood of that stimulus being present at half-hourly intervals was increased by extra fluids, there still remained a considerable element of chance. Muellner (1960a, 1960b) postulated that reflex voiding of urine occurs in response to a full bladder and initial bladder control is first acquired in the presence of a full bladder. Controlled voiding in the presence of a partially full bladder comes only later, presumably as muscle control and discrimination of bladder tension become more refined. If this is so, it would seem essential that the sensation of bladder tension during initial acquisition be close to that which triggers reflex voiding. In addition, without the accumulation of waste in the bladder or bowel, no voiding can occur. This may explain the failure of many children in the contingent consequences condition to acquire the skills involved in bringing about voiding in the toilet.

In self-toileting, the first response to bladder or bowel tension is to tighten the perineal muscles and keep them tensed while the first part of the toileting sequence is carried out. Once the individual is in position at the toilet, these muscles are relaxed and voiding takes place. Tightening the perineal muscles in the presence of bladder or bowel tension is thus an essential part of the toileting sequence, which needs to be brought under environmental control and incorporated into the sequence if toilet training is to be successful. This response was not taught as part of the sequence in the Azrin and Foxx programme, although the regular pants checks and over-correction procedures attempted to teach it outside the toileting sequence. The individual felt his or her pants and, if they were dry, received a reward. This procedure, represented in Figure 6.5(a), clearly strengthened feeling the pants rather than tightening the perineal muscles. If individuals did learn to tighten the perineal muscles, it was more likely to be as a result of uncontrolled factors operating outside the programme itself. This was especially so since bladder or bowel tension, as the signal to tighten the perineal muscles, was not usually one of the stimuli present during the pants checks. During a typical half hour of training the individual could go through the toileting sequence, void in the toilet, then sit on the chair for, say, 20 minutes. During most of that time there was no sensation of bladder

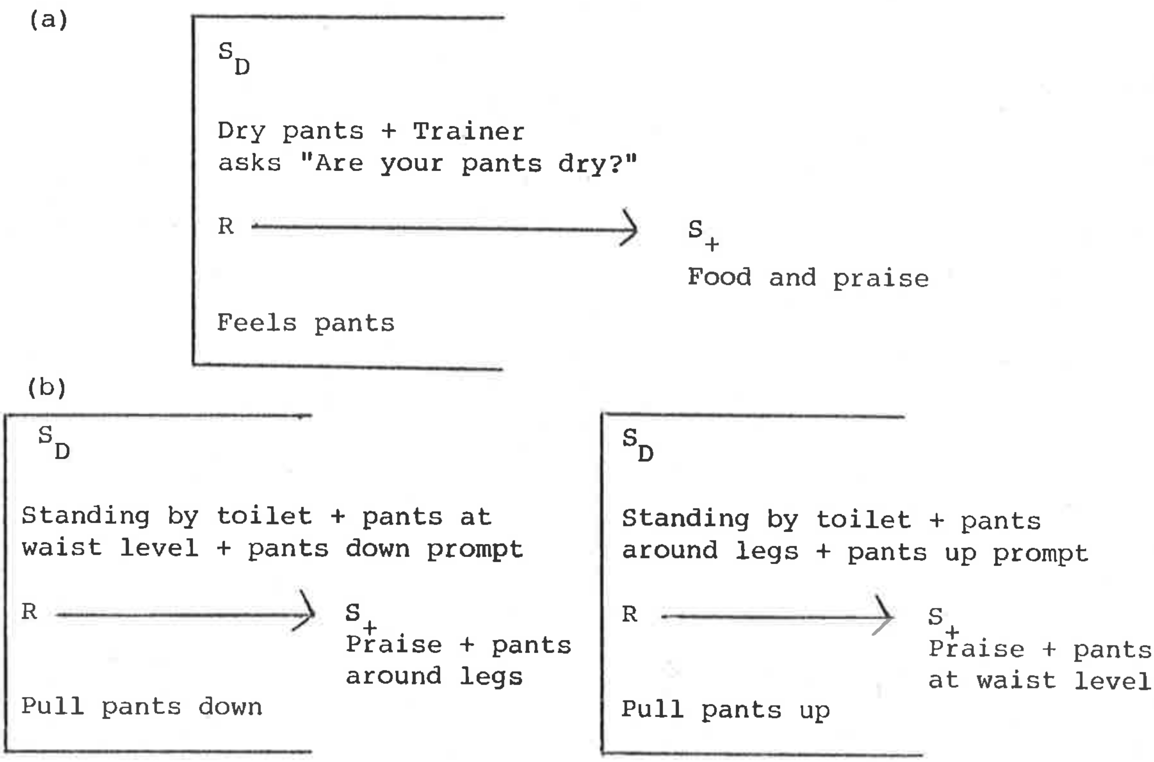


Figure 6.5. Analysis of the pants check procedure and the procedure to teach pants down and pants up in the Azrin and Foxx toilet training programme.

tension since the bladder had just been emptied. Tension may have built up towards the end of the half hour, but the pants checks occurred every five minutes no matter what state the bladder was in.

When voiding occurred in the pants, the punishment procedure was applied, and this was a mildly aversive experience for many individuals. As such, it operated to temporarily suppress voiding in the pants. Presumably, this aspect of the programme was intended to facilitate the strengthening of toileting as the alternative behaviour to voiding in the pants by weakening the likelihood that voiding would occur outside the toilet. That is, the procedure appeared to be one of differentially reinforcing one of two possible responses (self-toileting) while suppressing the alternative response (voiding in pants) with punishment. This has been shown in some circumstances to be a more effective technique for strengthening one of several operant responses (W.I. Gardner, 1969) than strengthening alone, or strengthening in conjunction with extinction of the unwanted response. However, for this to occur reliably, a common discriminative stimulus is needed to signal that the two responses will lead either to reinforcement or punishment. In the toileting sequence this stimulus should be bladder or bowel tension. However, while bladder or bowel tension was present at the time of voiding in the pants during the Azrin and Foxx programme, it was only present on some occasions when the alternative toileting sequence was performed.

A further problem with the punishment procedure arose during this study with those individuals for whom it was a pleasurable rather than an aversive experience, or for whom it was so aversive that the emotional reaction was disruptive. In the first instance, voiding in the pants did not decrease and, in some cases, such as Child 1, increased in frequency. In the second instance, other elements in the toileting sequence also became aversive. Furthermore, many trainers themselves found the procedure highly aversive. For all these reasons the muscle control required to hold back voiding was not brought under voluntary control, and children who did acquire this skill probably did so despite, rather than because of, the training procedures.

During this experiment as well as the pilot study, a number of individuals confused the order of responses when carrying out the toileting sequence. This may have been because the responses were not added to the chain one at a time. It may also have been because some of the linking stimuli were not established as discriminative stimuli within the chain. For instance, several trainees tried to pull their pants up or down when the opposite response was required, began to sit again after pulling their pants up, or began standing part way through seating themselves on the toilet. These responses had not come under stimulus control.

There are two aspects of stimulus control which require careful attention during training. One is the necessity to provide stimuli which the learner notices, so they can be discriminated and thus come to control the response during acquisition. The other is establishing stimuli which occur naturally in the sequence of responses as discriminative cues, so that they will continue to exert control over the response after it has been strengthened.

If we examine the two responses, pants up and pants down, as represented in Figure 6.5(b), the problem of stimulus control becomes clearer. In these two situations the position of the trainee by the toilet and the position of the pants on the body are the naturally occurring stimuli which should come to control the two responses. However, the position at the toilet was the same in both cases, leaving the position of the pants as the only indication of which response was required. The two different prompts were designed to aid this discrimination during acquisition but, unless the person actually learned to pay attention to the position of the pants, environmental control could not be achieved reliably. Stimulus control of the pants up and down responses was often difficult to achieve in the Azrin and Foxx programme because the salience of the two pants positions as discriminative stimuli was much less than the salience of the presence of the toilet, which was a stimulus common to both responses. This was a particular problem for children who did not readily pay attention to the pants position. Moreover, in normal self-toileting, there is the additional discriminative cue of bladder or bowel tension which was often not there during toileting trials in this programme. Toileting trials which occurred only in the presence of bladder or bowel tension would enable this stimulus to become an additional, naturally occurring discriminative stimulus for pants down, and its absence to signal pants up. The individual would thereby have two discriminative stimuli to signal which pants response was required. Environmental control by the natural links in the chain under these circumstances would thus be more likely to be established and maintained after withdrawal of the prompts.

A similar discrimination problem existed in relation to the sitting response, which was often performed before pulling the pants down, after standing, or after pulling pants up. Presumably, once the prompt was withdrawn, the position of the pants was not well established enough as a cue to signal which response was required. The discrimination problem for both the sitting and standing responses was made even more confusing by the frequent toileting trials which occurred during training in the absence of bladder or bowel tension. Bladder or bowel tension as an essential condition for toilet sitting should relieve some confusion in relation to sitting. The confusion for some retarded children about when to stand is not surprising when one considers that the cessation of voiding and the resulting relief from bladder or bowel tension is the only cue in normal self-toileting which signals that standing is appropriate. Many toiletings during bladder training did not result in voiding, and so it is unlikely that this cue became firmly established as the signal for standing.

The standing, pants up and toilet flushing responses were those mastered least well during training in both this and the pilot study. Some individuals did not acquire them at all. Apart from the problems of stimulus control just discussed, a further obstacle to successful learning was the placement of the primary reinforcer. This was delivered party-way through the chain, contingent on voiding rather than on completing the entire sequence. Thus the last three responses had no clear relationship to the major reinforcing stimulus, and there was no mechanism for establishing their linking stimuli as conditioned reinforcers. Attaching the primary reinforcer to voiding also disrupted that response on some occasions. Trainers generally gave the rewards immediately the toilet alarm began sounding. Several individuals then stopped voiding. They were in fact learning to void only enough to set off the alarm. This problem was overcome by holding back the reward until after voiding had ceased, but in practice the cessation of voiding was often difficult to detect. This problem should not arise if the primary reinforcer were removed to the end of the chain.

The above analyses suggest that it ~~was~~ may have been the inadequate application of learning principles which prevented the training strategies from having clear effects on the acquisition of self-toileting sequence. This was especially so in relation to contingent consequences. The major reward was attached part-way through the chain and therefore could not operate to cement all the elements of the chain into a smooth sequence or strengthen the entire chain as a unit. Furthermore, it was understandable (post hoc) that reliable bladder and bowel control was not achieved, since the usual stimulus conditions for behaviour change were not adhered to. Nevertheless, most children did improve, so confirming the value of an intensive structured programme of training. In addition, there was some evidence that the training strategies enhanced acquisition of specific elements in the self-toileting chain to which they were applied.

These findings raise a methodological issue of considerable importance to the study of complex human behaviour in general, and one which has rarely been addressed by applied researchers. It concerns the choice of response classes and dimensions which will both represent the behaviour of interest, and be susceptible to the environmental manipulations being studied. When the behaviour can be controlled as a single unit, this choise usually involves only a single response class, defined and quantified along one dimension such as frequency or duration. Decisions about appropriate response classes and dimensions become much more difficult when the behaviour of interest cannot be controlled as a single unit.

This study confirms the view, expressed in Chapter 3, that the acquisition of self-toileting does not initially result from environmental operations directed at the behaviour as a single unit. Rather, it involves the acquisition of a number of discrete responses which only function as a unit once they are well-established and performed together in the correct order. This may be true for all complex behavioural sequences. However, many human skills are made up of responses which already exist in the individual's repertoire, so that simple strengthening of the entire sequence as a unit is possible. When individuals do not have most of the elements in their repertoire, simple conditioning may not be effective. Therefore, persons who have few of the component skills will need training which incorporates procedures directed at establishing each response and joining the responses into a smooth sequence.

One response measure will not reflect this process, nor will it reveal which procedures are most effective or which responses are not brought under environmental control when acquisition is incomplete. This is so whether the chosen response measure represents only one element in the chain or the entire chain as a single unit. This study clearly points to the need for a set of measures which represent each discrete response to be acquired, as well as an overall measure which will show whether these responses have been correctly sequenced. For example, the frequency of voiding accidents has been the sole response measure in most toileting research. In the present study the specific measure of voiding accidents did not reveal that different elements in the chain responded differently to both structured toileting and the three training strategies. This fact only emerged because a number of measures were examined. It was also shown that an overall measure of toileting such as the Balthazar toileting scale or time in training did not reflect the operation of specific training procedures on each response in the chain. It was only when several aspects of toileting behaviour were observed that the complex nature of training effects and the existence of procedural problems were disclosed.

The varying responses of each measure to training suggest that the effects of particular training strategies were quite specific to those skills at which they were directed. Thus, the self-management tasks were specifically enhanced by guidance, which was the training strategy applied directly to their performance. However, the measure which reflected this effect was a composite of six self-management responses occurring at different points in the self-toileting sequence. As such, it could not show the possible influence of the other two strategies on each of the six responses. It is possible, for instance, that contingent reward also enhanced the acquisition of these tasks. This was not revealed in the composite measure because the major reward was given part way through the sequence, and therefore could only have an effect on those three self management tasks which preceded it. Separate measures of these tasks may have shown this contingency effect. The measure of time taken to perform the first four toileting tasks was also a composite measure incorporating both the first three self-management tasks as well as the speed with which voiding was initiated. Although all three training strategies appeared to affect this measure, these effects were difficult to interpret in relation to guidance and contingent alarms. They might have emerged more clearly in measures of each individual response.

6.6. CONCLUSIONS

Despite the procedural and measurement problems which became evident during this study, the Azrin and Foxx toilet training programme did lead to ~~considerable~~ improvement in self-toileting for many trainees. In addition, contingent rewards, guidance, and contingent alarms appeared to enhance some components of self-toileting, although the evidence for these effects was complicated by the inadequate analysis of the behavioural sequence involved in toileting and the composite nature of the response measures.

These findings indicated that it would be worthwhile pursuing the investigation of factors which may enhance the acquisition of self-toileting using a training programme more firmly based on a careful functional analysis. Therefore, a new toilet training programme was designed to incorporate the principles of reinforcement, chaining and stimulus control. In addition, measures were chosen which would allow each response in the chain to be monitored throughout training. It was hoped that the effects of particular training strategies would thereby be revealed more clearly, and an experiment to investigate this is described in the following chapter.

CHAPTER 7.

REINFORCEMENT AND CONTINGENCY IN THE TOILET TRAINING OF RETARDED CHILDREN WITH A CHAINING PROGRAMME

7.1. INTRODUCTION

The study of factors involved in the Azrin and Foxx toilet training programme (Azrin & Foxx, 1971; Foxx & Azrin, 1973b), described in the last chapter, found some evidence that specific training strategies enhanced the acquisition of self-toileting. However, only some components of toileting were affected, while others were not acquired well enough to reveal any effects. The programme did not adequately strengthen all the components of toileting, or join them together as a smooth and correctly sequenced performance. It was hypothesized that this may have prevented important training strategy effects from showing up.

For this reason, a new set of training procedures was devised, based on a detailed functional analysis of toileting as an operant chain. It was considered that this would allow a more effective application of learning principles and, therefore, more reliable acquisition of the entire toileting sequence. The new chaining programme was used in the study reported in this chapter to examine further the contribution of specific training strategies during acquisition.

The most puzzling result during investigation of the Azrin and Foxx programme was the failure to find clear and consistent effects of contingent consequences. Not only is the effect of consequences central to many learning theories which deal with the acquisition of new behaviour (Hilgard & Bower, 1975), but toileting has generally been regarded as an intrumental response which is particularly amenable to the effects of consequences (Ellis, 1663; Gardner, 1971; Watson, 1967). Consequently, it was this aspect of environmental control which was manipulated in this study. If toileting is an instrumental response, then manipulation of consequences in an environment which provides sufficient behavioural control should lead to clear effects on acquisition. If consequences cannot be shown to have clear effects on acquisition, then the analysis of self-toileting as an instrumental response and the efficacy of applying operant conditioning procedures to facilitate learning are questionable. However, there is considerable difficulty in analysing and demonstrating the effects of environmental manipulations in relation to every day human behaviour because complete environmental control is rarely possible. Moreover, the difficulties are multiplied when the behaviour to be controlled is complex. Since environmental control of toileting is likely to be problematical, even with improved procedures, it was considered that the effects of consequences would have more chance of showing up if all other conditions remained as constant as possible. Therefore, in this study no other environmental conditions were manipulated. In addition, the aspects of behavioural consequences to be manipulated were simplified. In the study described in Chapter 6, the consequences consisted of both the delivery of reward to strengthen self-toileting and the application of punishment to suppress voiding outside the toilet. The manipulation of this combination of procedures may have complicated the results, especially as the effects of punishment are less certain than the effects of positive reinforcement (see Chapter 4). Therefore, only the effects of manipulating positive reinforcement were considered in this study.

It was found in the study reported in Chapter 6 that, while contingent consequences enhanced the acquisition of some aspects of toileting, improvement generally occurred under conditions of both contingent and non-contingent consequences. However, it was not possible to conclude from this evidence that non-contingent consequences contributed to acquisition, since training involved the application of a number of procedures besides contingent and non-contingent consequences, and the observed improvement may have resulted from these procedures.

In this study it was thought that other factors besides reinforcement would also affect acquisition of toileting skills. Guidance is one such factor that has been shown to be effective in bringing about response acquisition in the absence of reinforcement (Macrae & Holding, 1965; Zaporozhets, 1961). The previous toilet training study suggested that it is also important in the acquisition of the self-management skills involved in toileting. Guidance was one of the training procedures used in the chaining programme designed for the present study. In addition, the programme incorporated a number of procedures besides guidance. These included the use of pants and toilet alarms to signal the onset of voiding, a loud "NO" at the onset of voiding outside the toilet, considerable practice after mastery had been achieved so that over-learning could occur, and extra fluids to increase the frequency of urination. Each of these procedures was intended to enhance acquisition of the toileting sequence.

When contingent reinforcement was added to these procedures it was expected to enhance acquisition. In most studies which have investigated the effects of contingency on human response acquisition, contingent reinforcement has been found to be important (see Chapter 4). The major responses involved in toileting are those which inhibit or initiate voiding. These are not amenable to guidance, or any other direct training procedure, since they involve the tensing and relaxation of the perineal muscles, and no method for observing or directly intervening in these responses has yet been found. In addition, the incorporation of these responses, together with the guided responses, into a co-ordinated response to bladder or bowel tension, may not be achieved without the use of contingent reinforcement to cement the elements into their correct places in the chain.

Non-contingent reinforcement was also expected to enhance acquisition, although to a lesser extent than when it was contingent on performance. In most studies of contingency, non-contingent reinforcement has had little or no effect (see Chapter 4). However, the findings are not as clear cut in relation to complex human learning in naturalistic settings. Several investigators have found increases in appropriate classroom behaviour (Brigham, Finfrock, Breunig & Bushell, 1972; Cormier, 1970; Kazdin & Forsberg, 1974) and work behaviour (Waters, 1980) under conditions of non-contingent reinforcement. Although non-contingent reinforcement was less successful than contingent reinforcement in these studies, it did lead to considerable improvement.

In all four studies, reinforcement was provided in an environment where many other behavioural influences were also occurring. For example, the teachers in the three classroom studies provided reinforcement while also continuing their normal teaching activities. This was not unlike the environment in the present study where a range of training and behaviour management procedures were being used in a busy training environment. The retarded subjects in Waters' two experiments were employed in a sheltered workshop where supervisors and other workers frequently interacted with them. Both of these studies included a no reinforcement condition in the design. Contingent reinforcement produced the largest increases in work behaviour (Experiment 2) and in work output and attention to task (Experiment 9B). However, both contingent and non-contingent reinforcement were significantly more effective than no reinforcement.

For these reasons, the effects of reinforcement and contingency were differentiated from the effects of the other factors in the chaining programme by comparing three conditions. One consisted of training during which no systematic reinforcement was given. The two remaining conditions added either contingent or non-contingent reinforcement to the training procedures. It was hypothesized that toileting skills would improve as a result of training in the absence of positive reinforcement. However, both contingent and non-contingent reinforcement were expected to enhance acquisition even further, with contingent reinforcement having the greatest effect. It was therefore hypothesized that improvement would be greater in the contingent than in the non-contingent condition, and both conditions would result in greater improvement than no reinforcement.

The relationship of initial toileting ability, length of institutionalization, age and general intelligence with improvement in toileting were again examined in the present study. Past studies have found that these variables predict the likelihood that toileting skills will be acquired under conditions of standard care (see Chapter 6), and the two latter variables appear to predict the amount of progress during training (Smith & Smith, 1977). Initial toileting ability also predicted how much progress subjects made during toilet training in the study reported in Chapter 6.

Variables such as these have often been used to predict the likelihood of achievement in retarded persons (Clarke & Clarke, 1974; Smith & Sanderson, 1966). However, there is some evidence to suggest that at least general intelligence and initial performance on specific tasks do not predict the likelihood or amount of improvement when effective training is provided.

This has been demonstrated in relation to spatial relations tasks (Tizard & Loos, 1954), industrial tasks (Clarke & Hermelin, 1955) and cognitive tasks (Gerjuoy & Spitz, 1966). On the basis of this evidence, it was thought that variables which show some relationship to untrained improvement in toileting may not predict improvement when training is provided, especially if that training is highly structured and provides opportunities for over-learning (Ferguson, 1954).

A particular aspect of toileting which was considered in more detail in this study was the complexity of the skills involved. As was noted in Chapter 6, training strategies appeared to have different effects on different components of the toileting sequence. Thus, providing contingent consequences enhanced the speed with which the tasks preceding the major reward were performed, but did not appear to influence the acquisition of bladder and bowel control or increase the likelihood that trainees would toilet themselves independently. Differential effects of this kind may also indicate that the components of toileting respond in different ways to environmental consequences. In order to evaluate this possibility, separate measures of each response in the toileting sequence were devised.

7.2. METHOD

Three groups of six children were toilet trained using the chaining procedures described in Section 7.2.3. One group received contingent reinforcement during training, the second received non-contingent reinforcement, and the third received no reinforcement.

7.2.1. Subjects

The number of children in the institution requiring toilet training had reduced since the beginning of the pilot study described in Chapter 5 to the point where there were not enough suitable subjects to allow satisfactory matching of groups for this study. Therefore, both institution children and children living at home were included. Trainees for the study were selected from a pool of referrals for toilet training in the Intensive Training Unit. Referrals consisted of children already on the waiting list and children who were referred as a result of publicity about this study.

The criteria for selection were the same as those used in Study 1 and described in Section 6.2.1. However, the assessment of medical problems was slightly different from that used in Study 1 at the request of the medical officers involved. They considered that a routine rectal examination subjected children to unnecessary discomfort and should only be used when a bowel abnormality was suspected. Instead, a micro-faeces test was used to detect organisms which may interfere with bowel functioning. It was also decided that the micro-urine and culture were only indicated when the ward urinalysis was abnormal, and that the expense of the multi 12 test for urea and creatinine levels was unjustified since it only detected extremely rare conditions. Except for these changes, the medical assessment form was the same as that described in Appendix 2.1.

The selection process left 28 children, from whom 18 were selected and divided into three groups of six. Groups were matched for pre-training toileting ability as measured by the Balthazar day time toileting scale (Balthazar, 1971), general intelligence as represented by the Social Quotient (SQ) on the Vineland Social Maturity Scale (Doll, 1936), and age in the same way as for Study 1. Group means for these three variables are shown in Table 7.1.

TABLE 7.1. Distribution of pre-training day time scores on the Balthazar toileting scale, Social Quotient (SQ) on the Vineland Social Maturity Scale and age.

GROUP	MEAN BALTHAZAR SCORE	MEAN SQ	MEAN AGE
1	27.50	29.58	10.07
2	25.00	26.05	10.26
3	23.83	27.30	9.61
All Groups	25.44	27.64	9.98

Note: Differences between groups on these variables were not significant using one way analysis of variance.

Equal numbers of institution and home children were selected and allocated to each group. An attempt was made to ensure that these two categories of children did not differ significantly on the above three variables. This was achieved for pre-training toileting ability and age, but not for SQ (see Table 7.2). Diagnosis, aetiology, additional problems and ongoing treatment for each of the 18 children are shown in Appendix 7.1.

TABLE 7.2. Distribution of pre-training scores on the Balthazar day time toileting scale, Social Quotient (SQ) on the Vineland Social Maturity Scale and age for children living at home and in the institution.

PLACE OF RESIDENCE	MEAN BALTHAZAR SCORE	MEAN SQ	MEAN AGE
Home	23.56	35.88	7.92
Institution	27.33	19.40	12.04

Note: The differences between the Home and Institution children were tested using t-tests. the results were as follows:
Mean Balthazar Score: $t=0.86$, $df=16$, $p>.05$
Mean SQ: $t=2.91$, $df=16$, $p<.05$
Mean age: $t=2.56$, $df=16$, $p>.05$

Two additional children were originally selected for training. However, they became self-toileting during the baseline period and so were replaced. Their performance is discussed in Section 8.2.7.

7.2.2. Setting trainers, equipment and materials

This study took place in the Intensive Training Unit at Strathmont Centre, and its organization was therefore determined largely by the organization of that Unit. The floor plan of the Unit is shown in Appendix 7.2. Each child attended the unit from 9.00 a.m. until 3.30 p.m. each weekday during training. During the remainder of each day and during weekends they took part in their normal activities with no special procedures for toileting. Three children were trained at a time as there were only three toilets available, and trainers were also involved in the other programmes provided by the Unit.

Forty trainers were involved during the study. They included Mental Deficiency Nurses and trainee nurses who were assigned to the unit for varying periods of time on a roster of two days on and two days off, two permanent members of the Unit staff and part-time volunteers. The author was also involved in the day to day training as well as supervising and training staff. Before becoming involved in the study, trainers read a detailed description of the procedures and recording methods used in the chaining programme, viewed a video-taped demonstration of the procedures, and then spent three days observing and practising each procedure under the guidance and supervision of experienced trainers. Parents of home children generally assisted with the training for at least eight hours a week under the supervision of trainers. Trainer expectancies and other trainer variables were controlled in the same way as in Study 1 (see Section 6.2.2.).

During training, each trainee wore a pants alarm and each toilet was fitted with a toilet alarm. These differed from those used in Study 1 in a number of respects. They were lighter and more robust than the original alarms. However, the major difference was in the toilet alarm, in which the tone was replaced by a red light which showed when urine or faeces bridged the gap between the sensors in the bowl. This modification was made because several children stopped voiding in the toilet at the onset of the tone during Study 1. It was considered that this disruption could be avoided by using a light. The modified alarms without the addition of the light are described in detail in the manual (Appendix 9).

The other materials used during training were the same as those used in the pilot study and Study 1 (see Section 5.2.2). Examples of the record sheets can be found in the manual (Appendix 9).

7.2.3. <u>The Chaining Programme</u>

The chaining programme is described in full in the manual (Appendix 9). This manual was initially designed for the Staff of the Intensive Training Unit, who have incorporated the programme into the range of services which they offer to clients.

The self-toileting sequence was presented to the learner as a chain to be acquired, starting with those elements at the end of the sequence and progressing back through the chain in reverse order to that in which elements would eventually be carried out (see Figure 7.1). The main toileting sequence incorporating the naturally occurring linking stimuli is represented down the centre line of the figure, with the programmed discriminative stimuli branching to either side. During the strengthening of each response element, a pre-determined response was required before the next element was added for strengthening. Trials for pants up and standing from the toilet, as the

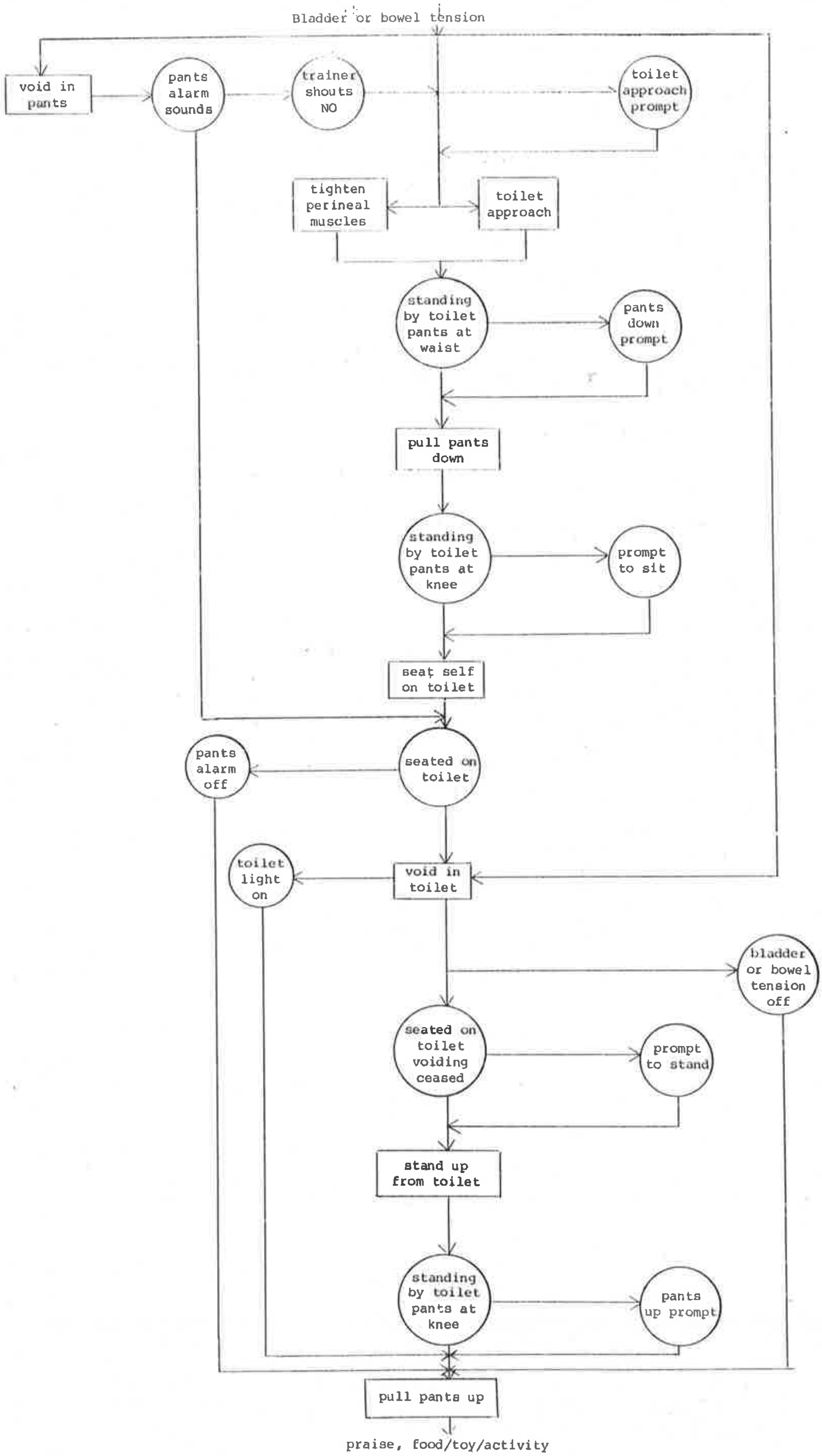


Figure 7.1. Representation of the chaining programme used to toilet train children: Circles denote discriminative stimuli and rectangles denote the appropriate response.

first two responses to be learned, occurred three times every half hour during training. However, once the third response, voiding in the toilet, and following responses were added for strengthening, bladder or bowel tension became an essential discriminative cue. Consequently, trials only occurred when this stimulus was present.

The sounding of the pants alarm indicated the onset of voiding in the pants. Since bladder or bowel tension is always present at the time of an uncontrolled voiding, all trials during acquisition followed the sounding of the pants alarm. The trainer shouted "NO" as the alarm sounded. This procedure, first reported by Van Wagenen and associates (Mahoney, Van Wagenen & Meyerson, 1971; Van Wagenen, Meyerson, Kerr & Mahoney, 1969), generally startled the individual into tensing the perineal muscles, thus stopping voiding. The learner was then quickly moved through the toileting sequence by the trainer, but was not required to initiate any response until the one to be strengthened was reached. The toileting trial began at this point, using prompts and physical guidance to shape each response.

Most of the response elements of this chain already occur frequently in the repertoire of any retarded person who may be trained using this programme. For instance, all trainees frequently walked, seated themselves, remained sitting for long periods, got up from a sitting position, voided and held back voiding for a while. Incorporating these responses into the self-toileting sequence generally required only that they be brought, as units, under the discriminative control of the natural linking stimuli in the chain. However, the pants down and pants up responses were often incomplete or did not exist at all before training. When this was the case, the sub-loops shown in Figure 7.2 were added to the chaining procedures, using the usual backward chaining methods.

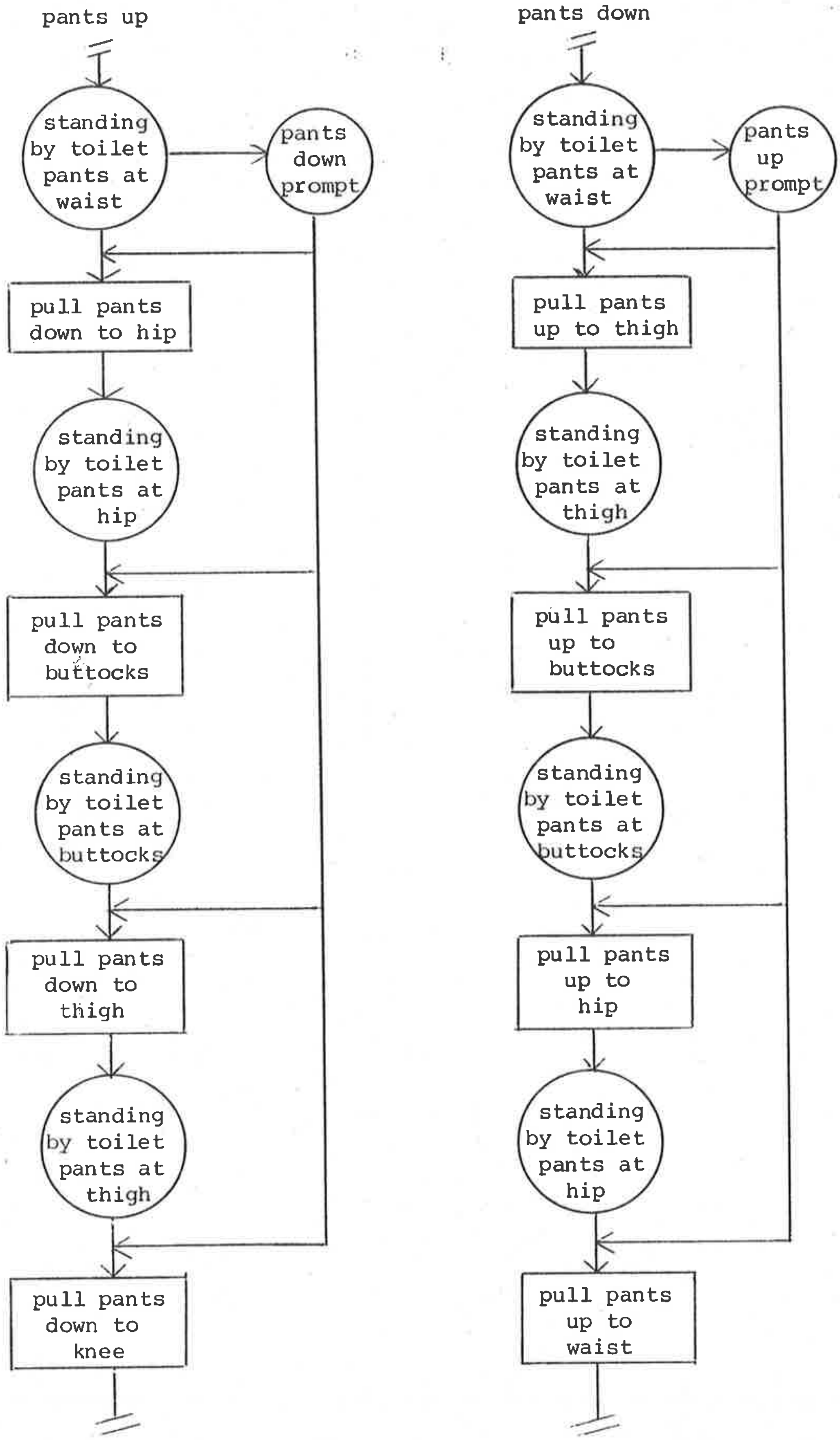


Figure 7.2. Sub-loops in the chaining programme for training pulling pants up and down.

The loud "NO", contingent on voiding in the pants, was delivered whenever voiding occurred outside the toilet bowl. It was arranged so that this response would become a voluntary action to avoid the loud "NO" and the pants alarm, which thus acted as negative reinforcers. If perineal tightening was acquired as an avoidance response, then continuing bladder or bowel tension became a discriminative stimulus to maintain the response in its natural sequence. However, occasionally voiding was not interrupted by the loud "NO", especially during the early trials. Under these circumstances there was unlikely to be any waste left to void in the toilet. When this occurred, a further branch of the chain was followed, as shown in Figure 7.3. The branch shown here also represents the sequence followed when the individual began voiding outside the toilet bowl again at any stage during the toileting sequence.

The theoretical advantage of these procedures over the Azrin and Foxx procedures (1971), resided in their placement in the sequence. The aversive consequence and the positive reinforcement were both attached to the discriminative stimulus of bladder or bowel tension. Eventually bladder or bowel tension should have come to signal that tightening the perineal muscles before any voiding occurred would allow the learner to avoid the aversive stimulus, while performance of the toileting sequence would lead to the reward.

The arrangement of discriminative cues attempted to overcome the confusion which some children in Study 1 experienced during the Azrin and Foxx programme. The pants alarm continued to sound during the performance of the first four responses which normally occurred in the presence of bladder or bowel tension during toileting. It was intended that the pairing of that tension with the alarm would bring it into awareness so that it would eventually come to exert control on its own.

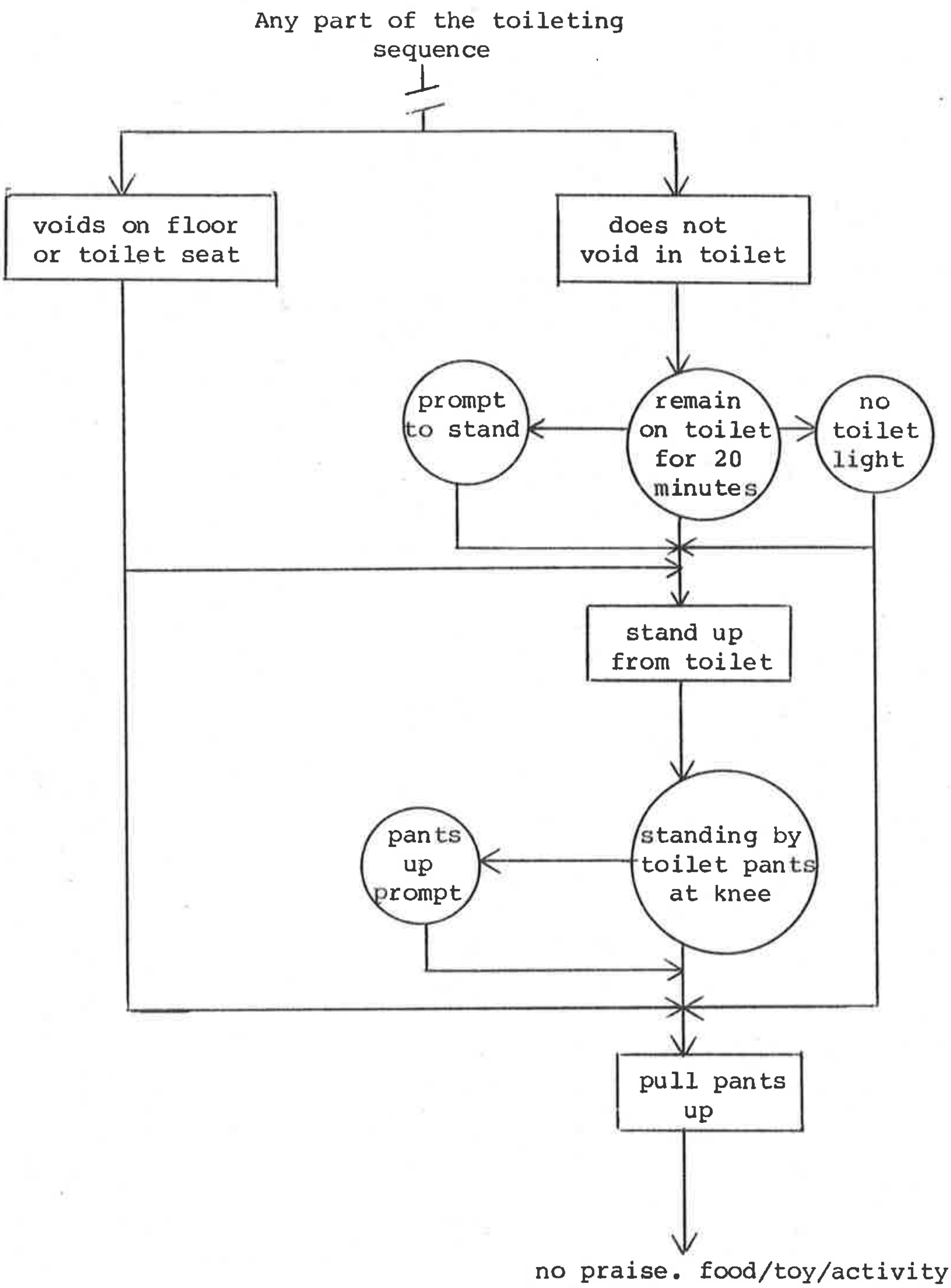


Figure 7.3. The sub-loop in the chaining programme showing the procedures used when voiding continued after the loud "NO" and when voiding did not occur in the toilet.

Voiding in the toilet was likely to occur reflexively, during the initial trials at least, once the child relaxed after being seated on the toilet and the pants alarm was disconnected. The onset of voiding in the toilet switched on a toilet light which remained on until the child left the toilet cubicle after pulling the pants up correctly. Thus, the light was on during the last three responses in the toileting sequence. These responses normally occurred during the relief from and absence of bladder or bowel tension. Consequently, as a result of the chaining process, the light became a conditioned reinforcer to strengthen perineal relaxation and voiding. It also became a discriminative stimulus which signalled that standing and pulling up pants were appropriate. It was hoped that the pairing of relief from bladder or bowel tension with the light would allow that state to exert control over these responses. Thus, the pants alarm and bladder or bowel tension became discriminative stimuli for the sequence, perineal tightening, toilet approach, pants down and sitting responses, with each response also having its individual discriminative stimulus. That sequence was therefore differentiated from the final sequence of standing and pants up which occurred in the presence of the toilet light and relief from bladder or bowel tension. This arrangement was also intended to bring the pants position into awareness so that it could add to the discriminative control of the pants down and pants up responses. The intention of this arrangement of stimuli was to provide the necessary controls which would establish the responses in their correct order.

Once the learner carried out the entire toileting sequence without voiding in the pants, discrimination of bladder or bowel tension could reasonably be assumed to exist. When the entire chain was self-initiated in this way several times, it was coming under the control of bladder or bowel tension. Once a near continuous rate of accurate toileting in response to bladder or bowel tension alone was reached, the chain was regarded as established. No further strengthening of elements in the chain occurred and the remaining programmed stimuli were gradually faded. As each response in the chain was acquired, the prompts and physical guidance were also faded. Similarly, at the end of training, the trainees were gradually moved further away from the toilet until they were moving freely about the unit. Once accident-free, selt-initiated toileting was again occurring reliably, the pants and toilet alarms, then the extra fluids, were removed, and the trainees were ready to resume their usual activities with the addition of a simple maintenance programme to help them transfer their new skills.

7.2.4. Design

All 18 children were trained using the chaining programme described above. Six children received contingent reinforcement at the end of each trial during which correct performance occurred, whether or not prompts or guidance was used. Another six children received non-contingent reinforcement, and a third group of six received no reinforcement.

Contingent Reinforcement. Rewards were presented immediately the pants were in the final correct position at the waist, since pants up to the waist was always the final response in every trial. Thus, rewards were received as the child was about to move away from the toilet. The one exception to this occurred once toilet voiding was added to the chain.

If any trial was performed without voiding in the toilet, the trainer turned away from the child when the pants up response was finished, and no reward was given. The trainer continued to give no reaction even if the child actively sought a response.

Non-contingent Reinforcement. Toileting trials during training occurred in exactly the same way as for the first group, except that no reward was given at the end of successful trials. Trainers remained impassive and did not react. The child was allowed to walk out of the toilet, the trainer emptied the bowl in the toilet and carried on with any other tasks required at the time.

Whenever a successful trial occurred, a time during the next 30 minutes in the case of phases 1 and 2 or 60 minutes in the case of phases 3 to 7, was chosen and entered in the place on the recording sheet set aside for this purpose. The chosen time was at least ten minutes after the successful trial. When this time was reached, the reward was given and marked on the record sheet under that time.

On rare occasions a toileting trial was occurring at the time when reward was scheduled. It was not practically feasible to interrupt a trial in order to deliver reward. Furthermore, reward which occurred during occasional toileting trials may have operated on a variable ratio schedule, thus establishing a contingency. The intention of this procedure was to apply reinforcement which was not contingent in any way on toileting. Consequently, on these occasions, reward was delayed to a time which was at least ten minutes after the completion of that trial. In practice this meant that rewards occurred at irregular intervals during the day as long as toileting was not occurring. Trainers found initially that they had to actively stop themselves from showing signs of approval, but very quickly learned to relax and merely observe or carry out other tasks.

No Reinforcement. Training was carried out in the same way as for the first two groups. However, no reward, praise or affection was given at any time during toileting trials. Trainers merely carried out the procedures and did not react if toileting responses were completed successfully. In addition, no reward was scheduled for any other times during training.

Dependent variables. In Chapter 6, the issue of measurement was discussed and some possible measures were extracted from the daily training records. Accident rate has been used traditionally as the sole measure of toileting in most toilet training studies. However, as reported in Chapter 6, it has proved to be misleading as an indicator of self-toileting ability. In the previous study as well as in those reported by Watson (1968) and Hundziak, Maurer and Watson (1971), toilet use increased, but there was often no accompanying decrease in voiding accidents.

Clearly additional measures were needed which would directly represent toileting performance. The Balthazar toileting scale described in Chapter 6, appeared to provide such a measure. However, once self-toileting was analysed as a number of responses joined together as a chain, it became clear that no one measure could adequately quantify what was in fact a complex series of behaviours. If we considered that the chaining process required careful monitoring of each response to ensure that it was strengthened adequately before the next response was added, the need for a measure of each discrete response in the chain becomes apparent. The composite score on the Balthazar toileting scale was a useful overall measure of selt-toileting ability, but did not provide a measure for each response in the sequence. Therefore separate measures of each response seemed especially important.

The experimental focus of this study was the effect on self-toileting acquisition of manipulating the reinforcement component of the training procedures. In the previous study the five toileting measures which were taken from the training records responded in different ways to the three training factors which were studied. Although it is possible that the effects were inconsistent in that study as a result of the inadequate training regime, it could also be the case that different responses in the chain may be differentially affected by different training aspects. For instance, one response in the chain may be affected differently by a training technique which is directly applied to it than by one which was applied to a response further down the chain. If this was the case, it is not surprising that the composite measure provided by the Balthazar day time toileting scale did not vary as the three training factors were manipulated.

For all these reasons it was considered necessary to devise measures of the seven responses represented in the chain shown in Figure 7.1, as well as an overall measure of the total chain. These are described below. Calculation methods for all measures are described in detail in the manual (Appendix 9).

Reliable observation and recording are very difficult to ensure in an applied setting. It was therefore thought necessary to keep the amount of recording to a minimum while at the same time obtaining measures of each response. Therefore, it was decided that once mastery of each of the five responses which did not involve bladder or bowel control was achieved to the pre-determined criterion, no further records of that response would be kept. Experience from pilot work had already suggested that at this point staff interest in the record waned, since training was no longer directed at that response and little further improvement was likely. However, the programme allowed for deterioration in any response after mastery had been achieved by requiring a return to the point in the programme where strengthening and recording of that response occurred. In practice, this programme contingency was rarely required.

The measures were calculated for each day from the continuous records and are as follows:

1. Five separate measures of independence in toilet approach, pulling pants down, seating self on the toilet, standing from the toilet, and pulling the pants up, each rated on a scale of 0 to 5 (see Table 7.3).
2. Accident rate as a percentage of all voidings.
3. Size of accident rated on a scale of 1 to 5 (see Table 7.4).
4. Rate of voiding in the toilet as a percentage of all toiletings.
5. Time taken between being seated on the toilet and the onset of toilet voiding.
6. Rate of self-initiated toilet voidings as a percentage of all toilet voidings.

Scores on these measures were expected to increase with training, with the exception of measures 2, 3 and 5, which were expected to decrease with training.

TABLE 7.3. Rating scale for independence in the responses, toilet approach, pants down, sitting, standing and pants up.

AMOUNT OF ASSISTANCE GIVEN	RATING
No prompt, no guidance	5
Gestural prompt, no guidance	4
Verbal prompt, no guidance (with or without a gesture)	3
A little guidance (with or without a prompt)	2
Guidance about half the time (with or without a prompt)	1
Guidance for approximately the whole task (with or without a prompt)	0

TABLE 7.4. Rating scale for size of voiding accident.

AMOUNT VOIDED DURING ACCIDENT	RATING
Few drops of urine and/or smear of faeces	1
Small patch of urine and/or small faeces bolus	2
General dampness and/or partial bowel motion	3
Urine and/or faeces in pants with a few drips and/or small amount of faeces escaping from pants	4
Large puddle of urine and/or full bowel motion	5

Although no direct measure of perineal tensing and relaxation was possible, it was hoped that measures 2 and 3 together and 4 and 5 together would reflect small increments in performance of these skills. Percentages were used for measures 2, 4 and 6 in order to reduce the variability due to such factors as fluid intake, temperature and health. This was especially necessary since extra fluids were given during part of the programme (see Section 7.2.3).

Data from which the ten measures were derived were recorded during a baseline period and throughout training. The record sheets for each stage are shown in the manual (Appendix 9). Observation and recording conditions were the same as in Study 1 (see Section 6.4) and, although reliability was not assessed because it was not practicable to introduce independent observers into the training environment, it was considered that these conditions ensured that reliability was high.

7.2.5. Procedure in detail

All procedures are described fully in the manual (Appendix 9) and will therefore only be outlined briefly here.

Baseline procedures. During the baseline period, children were helped to become familiar with the environment and trainers, suitable rewards were selected for each child, behaviour management procedures were designed, and sitting and wearing pants alarms were shaped when necessary in the same way as in Study 1 (see Section 6.2.7). In addition, performance on the ten toileting measures was recorded. Recording continued until performance was stable, or at least was not improving, for three consecutive days, after which training began.

Training procedures. Training was divided into seven phases. The first six phases taught the responses, shown in Figure 7.1, one at a time in reverse order, and in phase VII trainees practised the entire self-toileting sequence in increasingly natural situations while the last training procedures were withdrawn. Performance criteria, consisting of a pre-determined number of correct responses, were set for each phase, and a new phase was not introduced until the criterion for the previous phase was achieved. This arrangement ensured that over-learning of each skill and the entire toileting sequence occurred.

Phase 1 taught pulling pants up. Every half hour during training the trainee was positioned in front of the toilet with the pants at knee level, and prompted to pull them up three times. Guidance was used whenever necessary. If the trainee had none of the skills required for this response, pulling pants up was taught in four stages. Pulling from the hip was taught first, then from the upper thigh, the mid-thigh, and finally from the knee.

Once a predetermined number of correct responses occurred without guidance, the next stage was introduced. When the pants were pulled up from the knee without guidance, the prompt was systematically reduced in the same way. When the required number of responses had occurred without guidance following the full prompt, a less active prompt was used. This process continued until the pants were pulled up without a prompt or guidance immediately the trainee was in position at the toilet.

Phase II taught standing from the toilet and joined it to the pants up response in the same way. The trainee was seated on the toilet with the pants at knee level, and prompts and guidance were faded until the two responses were performed in sequence a number of times without assistance.

Phase III added toilet voiding to the chain. From this phase on, the trainee received drinks every half hour and sat close to the toilet, and the alarms were used. Trials occurred whenever the pants alarm sounded or when the trainee went to the toilet and carried out the entire toileting sequence correctly. On the sounding of the pants alarm, the trainer said "NO" loudly, and quickly did those tasks for the trainee which were not yet being taught, until the particular response being taught was reached. In phase III guidance for remaining seated was used if necessary until voiding occurred, or until 20 minutes had elapsed if voiding did not occur. Prompts and guidance were provided to teach sitting in the correct position during phase IV. These were faded as described for Phases I and II. Phase V taught the trainee to pull pants down to the knee before sitting, and phase VI taught toilet approach using the same system of fading. When necessary, these last three prompted responses were practised three times every half hour, as well as during toileting trials.

Phase VII was introduced after a predetermined number of successful self-initiations had occurred in succession with no more than two accidents during that time. This often occurred during one of the early phases before all the elements of the chain had been taught. Accidents were dealt with in the same way as during earlier phases, except that no reward was delivered following successful toileting. On rare occasions accidents began to occur during phase VII and the trainee was returned to the earlier phase again. During phase VII the trainee was moved further from the toilet each time a number of self-initiations had occurred with no accidents. The last four stages of this phase allowed the trainee to move freely around the unit. The alarms were removed, then the trainee was required to handle normal clothing during toileting, and finally the extra drinks ceased.

When the trainee had remained accident-free and had self-initiated toileting on at least eight occasions, he or she was returned to normal activities and a maintenance programme was carried out. Training continued until this last criterion was achieved, or for 28 days if training was not completed.

Maintenance procedures. The maintenance procedures were carried out by parent, teachers and institution staff under the supervision of the trainers. Instructions for maintenance were similar to those used by Foxx and Azrin (1973b) with the following modifications. All trainees were rewarded for self-initiated toileting. This was considered necessary, as teachers and institution staff were often in charge of several trainees and would have found different procedures for individual children difficult to handle in the midst of their busy routine. It was considered that an increasing number of toiletings would go unnoticed in the natural environment as care-givers gained more confidence in their charges' skill, thus ensuring that rewards were gradually faded so that natural contingencies could come to control toileting.

Voiding accidents were dealt with in the same way as during phase VII, except that the trainee was required to remain on the toilet for at least 10 minutes. Examples of the instructions and recording sheets for maintenance are to be found in the manual (Appendix 9). Trainees who did not complete training in the allotted time were also placed on a maintenance programme which was modified to fit the level of skill which they had achieved. In practice, all unsuccessful trainees had acquired the entire chain except for independent toilet approach. The maintenance procedures in these cases involved a prompt to go to the toilet at specified times with all other maintenance procedures being the same as in the full programme. Maintenance continued until 14 consecutive accident-free days had occurred, or for six months if this criterion was not achieved.

<u>Follow-up</u>. Follow-up assessment 7 to 14 months after the end of training, using the Balthazar day time toileting scale, was carried out by independent interviewers with no knowledge of the hypotheses or the experimental group to which each child belonged. The training of interviewers and the method of establishing reliability were the same as those used in Study 1 (see Section 6.2.6). Interviewers were available for a two week period. Therefore the follow-up assessments were all carried out during this period. The time of follow-up was determined so that all children had been without the maintenance programme for at least one month, as in Study 1. This also ensured that the length of time between the end of training and follow-up was as similar as possible to the follow-up times in Study 1, thus enabling a comparison to be made between the follow-up scores in the two studies (see Chapter 8).

7.3. RESULTS

All children progressed through most of the programme within the allotted time. Ten of the eighteen children achieved the training criterion. Their distribution across experimental groups, the average training time and training phase reached for each group are shown in Table 7.5. Trainers

TABLE 7.5. Number of children who completed training to criterion and average training time for each group.

GROUP	NUMBER COMPLETING TRAINING TO CRITERION	AVERAGE TRAINING TIME IN DAYS[a]	AVERAGE TRAINING PHASE COMPLETED (MAXIMUM 7)[a]
Contingent reinforcement n = 6	3	25.7	6.5
Non-contingent reinforcement n = 6	4	17.5	6.3
No reinforcement n = 6	3	22.0	5.7

[a] Differences between contingency and non-contingency, and between reinforcement and no reinforcement on these measures were not significant using planned comparisons.

believed that five of the eight remaining children would have reached criterion with a few more days of training, since their daily records showed that they were making steady progress through the training steps. However, the performance of three of the children was patchy and trainers were uncertain about the likely outcome of further training. Neither the provision of reinforcement nor the contingency of reinforcement made any significant difference to training time or the number of phases completed during training. However, progress through the training programme did not indicate how much the children had improved, since they all had some skills before training.

Performance on the ten toileting measures during training were used to indicate the amount of improvement that occurred. Mean scores on the ten toileting measures during the last three days of baseline (see Section 7.2.5) and the last three days of training are shown in Table 7.6. No significant differences were found between the baseline scores in the contingent and non-contingent groups, or between the groups which received reinforcement and the group which received no reinforcement when planned comparisons were made. Therefore, the differences between the baseline and end of training scores on each measure were used as indices of improvement during training (see Table 7.7).

The first five measures shown in Table 7.6 are of the skills which did not involve bladder or bowel control. These are presented in the order in which they were trained. All children reached the training criterion for the first three skills (a score of 5 was the highest possible score). Two children in the no reinforcement group showed no improvement in the fourth skill, pulling pants down, since they had only begun the training phase which taught this skill a short time before training was stopped (see Appendix 7.3). Two children in the non-contingent reinforcement group and three in the no reinforcement group showed no improvement in the fifth skill, toilet approach, since they had not begun the training phase which taught this skill. The gains which the two groups made in these skills, as shown in Table 7.6, reflected the performance of the remaining children. Some skills were performed perfectly at every toileting during baseline by some children, and therefore improvement was not possible. This was most noticeable in relation to the skills involved in pulling up pants and sitting on and standing from the toilet.

TABLE 7.6. Group means on the ten measures of toileting performance during the last three days of baseline and the last three days of training.

MEASURES	CONTINGENT REINFORCEMENT		NON-CONTINGENT REINFORCEMENT		NO REINFORCEMENT	
	BASELINE	END TRAINING	BASELINE	END TRAINING	BASELINE	END TRAINING
Independence in pulling pants up	3.72	5.00	3.55	5.00	3.12	4.88[c]
Independence in standing from toilet	4.67	5.00	4.80	5.00	4.68	5.00
Independence in sitting on toilet	3.48	5.00	4.88	5.00	4.02	5.00
Independence in pulling pants down	3.58	5.00	4.42	5.00	4.08	4.18[b]
Independence in toilet approach	3.53	5.00	2.72	4.52	2.75	3.17
Percent toilet voidings/total toiletings	78.23	94.23	51.65	97.10	65.55	92.75
Time taken to void in toilet[a]	2.43	0.13	1.40	0.13	0.20	1.35
Percent accidents/total voidings[a]	45.21	23.14	52.16	15.16	52.87	32.53
Accident size[a]	2.83	2.38	4.08	3.42	3.90	2.80
Percent self-initiated toiletings/ total toilet uses	19.75	69.21	16.92	79.97	13.50	45.55

[a] Scores decrease in size with improvement. All other scores increase in size with improvement.

[b] Four children achieved mastery and two children did not achieve mastery, becoming less independent.

[c] Five children achieved mastery and one child did not achieve mastery, but did reach the overall training criterion.

TABLE 7.7. Mean improvement scores on ten measures of toileting performance comparing end-of-training with baseline.

IMPROVEMENT MEASURES[a]	CONTINGENT REINFORCEMENT	NON-CONTINGENT REINFORCEMENT	NO REINFORCEMENT
Independence in pulling pants up	1.28[b]	1.45[b]	1.77[c]
Independence in standing from toilet	0.33[b]	0.20[b]	0.32[b]
Independence in sitting on toilet	1.52[b]	0.12[b]	0.98[b]
Independence in pulling pants down	1.42[b]	0.58[b]	0.10
Independence in toilet approach	1.47[b]	1.80	0.42
Percent toilet voidings/total toiletings	16.00	45.45	27.20
Time taken to void in toilet	2.27[c]	1.27	- 1.15
Percent accidents/ total voidings	22.07	47.84	20.34
Accident size	0.45	0.67	1.10
Percent self-initiated toiletings/ total toilet uses	49.46	63.05	32.05

[a] Differences were calculated in the direction such that all positive values indicate improvement

[b] All children achieved mastery

[c] All but one child achieved mastery

Performance on the five measures of bladder and bowel control was more variable. All but two children improved on the measures of toilet voiding and accidents, and all but one markedly increased the frequency with which they toilet themselves. In addition, 13 of the 18 children were voiding on the toilet immediately they sat down and had learned to stop voiding more quickly when accidents occurred.

The effects of contingency and reinforcement on improvement during training were analysed using the t test. Planned comparisons were made between the contingent and the non-contingent groups, and between the two reinforcement groups together contrasted with the no reinforcement group. Initial testing was done using the Manova subprogramme (Cohen & Burns, 1976) from the Statistical Package for the Social Sciences (Nie, Hull, Jenkins, Steinbrenner & Bent, 1975) in order to ascertain the effects of the pre-training toileting level, general intelligence and age as covariates. However, the effects of these variables were not significant and the t test results are therefore reported in Table 7.8 without covariance adjustments. The three measures of pants up, standing and sitting were not analysed, since all children achieved mastery in all groups, so that reinforcement was clearly not essential for the learning of these comparents.

The remaining seven measures were analysed. The effects shown in Table 7.8 were not always in the expected direction. However, differences were not significant, indicating that neither contingent nor non-contingent reinforcement enhanced the effectiveness of training. The one exception to these findings occurred in relation to the percentage of voidings which were accidents. All groups improved on this measure, but non-contingent reinforcement resulted in significantly greater improvement than contingent reinforcement ($t = -2.26$, $df = 10$, $p < .05$). This may have resulted from

TABLE 7.8. Fourteen t values testing the effects of (a) contingency and (b) reinforcement on mean improvement scores for seven of the toileting measures.

IMPROVEMENT MEASURES	(a) CONTINGENT VERSUS NON-CONTINGENT REINFORCEMENT t(10df)	(b) REINFORCEMENT VERSUS NO REINFORCEMENT t(16df)
Independence in pulling pants down	1.15	1.44
Independence in toilet approach	-0.28	1.17
Percent toilet voidings/ total toiletings	-1.75	0.24
Time taken to void on toilet	0.56	1.88
Percent accidents/total voidings	-2.26*	1.48
Accident size	-0.20	-0.59
Percent self-initiated toiletings/total toilet uses	-0.91	1.86

Note: In the table above, a positive t value indicates that the difference was in the expected direction, while a negative t value indicates that the difference was in the opposite direction from that expected.

* $p < .05$

the way accidents were treated in the chaining programme.

The loud "NO" which followed immediately an accident began appeared to induce the muscle action required to inhibit involuntary voiding, as indicated by the general decrease in accident size during training. In doing so, it probably acted as a negative reinforcer, and the muscle action thereby operated as an avoidance response. This procedure was immediately followed by toileting, with a reward delivered at the end of the chain whenever toilet voiding occurred in the contingent reinforcement condition. According to operant theory, the discriminative stimuli preceding each response in the chain should have acquired reinforcing properties as a result of this process (Millenson, 1967). The loud "NO" may also have come to function as a discriminative stimulus for the next element in the toileting chain which followed it. Therefore, it may also have acquired positive reinforcing characteristics, thus reducing its effectiveness as a negative reinforcer. However, if this did occur, it was not a strong enough effect to prevent the reduction of accidents in most trainees.

In Study 1, the magnitude of changes during training on two toileting measures was not large enough to allow any differential effect to appear. This may have been the case in this study. Therefore, overall mean improvement on each of the ten measures was tested against a null-hypothesis of zero change, using the t test (see Table 7.9). Improvement

TABLE 7.9. Overall mean improvement scores on ten measures of toileting and t values testing these means against a null-hypothesis of zero improvement.

IMPROVEMENT MEASURES	OVERALL MEAN	t VALUES (df=17)
Independence in pulling pants up	1.50	4.33 ***
Independence in standing from toilet	0.28	3.05 **
Independence in sitting on toilet	0.87	2.37 *
Independence in pulling pants down	0.70	2.28 *
Independence in toilet approach	1.23	2.55 *
Percent toilet voidings/total toiletings	29.55	4.16 **
Time taken to void in toilet	0.79	1.02
Percent accidents/total voidings	30.08	3.26 *
Accident size	0.74	1.79 *
Percent self-initiated toiletings/ total toilet uses	48.19	4.26 **

* $p < .05$ (one-tailed)
** $p < .01$ (one-tailed)
*** $p < .001$ (one-tailed)

was significant for all but one measure. This was the measure of time taken to void in the toilet. The lack of significance in this case was probably caused by the large number of trainees with baseline scores at or just below the best possible score, thus leaving little room for improvement. In addition, four trainees were actually taking longer to void in the toilet at the end of training. It was therefore concluded that, if contingency or reinforcement had influenced the amount of improvement, such influence could have been displayed in the other nine measures.

Improvement on the Balthazar day time toileting scale at follow-up was also analysed in the same way. Mean scores before training and at follow-up, and mean improvement for each group are shown in Table 7.10. Overall improvement at follow-up was significant when tested against a null-hypothesis of zero improvement ($t = 4.93$, $df = 16$, $p < .001$). However, the effects of reinforcement and contingency were not significant.

TABLE 7.10. Group means before training and at follow-up and improvement on the Balthazar day time toileting scale.

GROUP	BEFORE TRAINING	AFTER TRAINING & MAINTENANCE	IMPROVEMENT
Contingent reinforcement[a]	25.80	44.60	18.80
Non-contingent reinforcement	25.00	33.33	8.33
No reinforcement	23.83	33.33	9.50
All groups	24.88	37.09	12.21

Note: Differences in improvement scores between contingency and non-contingency, and between reinforcement and no reinforcement were not significant.

[a] One child died between the end of maintenance and the administration of the second Balthazar assessment, and therefore means for this group are based on n = 5.

The place of residence was not treated as a covariate during analysis since it was a nominal measure. However, the improvement of the home and institution children was compared using t tests (Table 7.11). The two groups differed significantly on only one measure; independence in toilet approach ($t = 2.14$, $df = 16$, $p < .05$). Home children improved more than institution children. However, they also had more room for improvement as the mean baseline score was much lower (mean baseline score = 2.72) than in the institution group (mean baseline score = 3.28). Consequently the evidence suggests that improvement during training was not generally affected by whether trainees live at home or in an institution. However, home children were significantly better at maintaining their skills in the natural environment. This was indicated by amount of improvement on the Balthazar day time toileting scale at follow-up (see Table 7.12). Improvement scores were greater for the home children than for the institution children ($t = 2.23$, $df = 15$, $p < .05$).

TABLE 7.11. Group means for improvement scores on seven measures of toileting performance comparing end of training with baseline for children living at home and in the institution.

IMPROVEMENT MEASURES [a]	PLACE OF RESIDENCE	
	HOME	INSTITUTION
Independence in pulling pants down	1.04 [b]	0.36
Independence in toilet approach	2.17	0.29
Percent accidents/total voidings	26.00	34.00
Accident size	0.62	0.86
Percent toilet voidings/total toiletings	24.93	34.17
Time taken to void in toilet	0.91	0.68
Percent self-initiated toiletings/ total toilet uses	56.89	39.33

[a] Differences were calculated in the direction such that all positive values indicate improvement

[b] All children achieved mastery

TABLE 7.12. Group means before training and at follow-up and mean improvement on the Balthazar day time toileting scale for children living at home and in the institution.

PLACE OF RESIDENCE	BEFORE TRAINING	AFTER TRAINING & MAINTENANCE	IMPROVEMENT
Home	23.56	39.89	16.33
Institution	27.33	33.00[a]	6.75[a]

[a] One child died between the end of maintenance and the administration of the second Balthazar Scale, and therefore means for this group are based on n = 5.

7.4. DISCUSSION

"The law of reinforcement, or law of effect, is one of the more important principles in all learning theory" (Hilgard & Bower, 1975, p. 561). Its importance is indicated not only by the huge volume of laboratory research which demonstrates the powerful influence of reinforcement, but also by the application of reinforcement principles identified in the laboratory to practical human problems (Bandura, 1969). The major thrust of much applied research has been to show that reinforcement which follows immediately on every performance of a specified response will increase its quality and frequency, while the absence of reinforcement will result in extinction (Resnick, 1971). This has been the concern in relation to toilet training. Little attempt has been made to isolate the effective components in toilet training procedures. Rather, it has been assumed that contingent reinforcement is the major essential element.

This study attempted to investigate whether positive reinforcement and its contingency were indeed important components when chaining procedures were found to be generally effective, whether or not reinforcement was provided.

Making reinforcement immediately contingent on performance did not appear to enhance learning. In fact, accident rate improved more when reinforcement was non-contingent. These findings raise a number of questions. The first concerns the other factors which were controlling acquisition. A second issue is that of contingency, its lack of effect in general and its deleterious effect in relation to voiding accidents. These will be dealt with one at a time.

The emission of the required behaviours in this training programme, as in much applied skills training, was forced or moulded. The five associated skills were elicited by prompts and physical guidance, while toilet voiding was generally ensured by only running trials when reflex voiding had already begun. This is quite different from the usual laboratory methods which place the organism in a bland environment and induce the required behaviour by applying consequences through shaping by successive approximations. In addition, each response in this study was practised many times, both during acquisition and after mastery had been achieved.

It is possible that acquisition of behaviour which is forced and over-learned in this way occurs somewhat differently from acquisition through induction by reinforcement. It may be that the former kind of learning is largely an associative processes through practice between the response and the stimuli in existence at the time (Guthrie, 1952). This process of learning what one practises was stated by Logan (1971), who suggested that one function of reinforcement is much the same as the function of instruction, in that it ensures that the behaviour occurs (the subject becomes willing to emit the behaviour so that it can be practised and thus learned). This interpretation suggests that ensuring the emission of the required behaviours through guidance and prompting took over the role which reinforcement usually plays and thus reduced its usually clear behavioural control.

Logan did not propose that reinforcement has no incentive function, but only that this other associative function is also important in learning. There is some evidence for this view from studies of conflicting responses in animals which were introduced after a first response had already been learned (Logan, 1969; Logan & Boice, 1969; Williams & Williams, 1969). However, the results from this study suggest that further more convincing evidence may come from a study of forced repetition under alternative conditions of reinforcement and non-reinforcement.

Of course, it is difficult to achieve a totally non-reinforcing condition in typical human skills training. The very presence of the trainer may be reinforcing as a result of the learner's past history. The moulding of behaviour already mentioned could also be seen as providing continuous feedback about the nature of the required responses, as well as providing a correction whenever incorrect responses occurred. The operation of response-feedback loops of this kind during acquisition has been espoused by various informational analyses of reinforcement effects (Atkinson & Wickens, 1971; Bloomfield, 1972; Estes, 1971).

If informational feedback is the major determinant of learning rather than the direct strengthening of associative connections espoused by strict S-R theorists, then physical guidance techniques used in the chaining programme probably had a more potent effect on acquisition than the extrinsic rewards provided in the reinforcement conditions. There is some evidence for this suggestion in the differing levels of success for the five associated tasks as compared with the two bladder and bowel control tasks. Mastery of the former was achieved by all children who were actually taught them, whereas few children achieved complete mastery of the two bladder and bowel control skills involved in inhibiting and initiating voiding. It is significant that during performance of these two skills there was no continual feedback. The training procedures were much more analogous to the usual S-R strengthening paradigm.

In fact, toilet voiding probably did receive immediate reward, even in the no reinforcement condition, in that the toilet light came on (a bridging signal) and the child was free to leave the toilet after voiding had been completed. In contrast, no voiding resulted in no light and a requirement to remain seated for a period of time (see Figure 7.3). Similarly, muscle action to prevent involuntary voiding outside the toilet resulted in avoidance of the loud "NO" in all three training conditions.

The discussion above goes some way towards explaining why the individual skill components were not affected by the presence or absence of positive reinforcement as defined in this study. In a training format like the one used in this study, the required tasks and their place in the entire sequence were made so clear that further extrinsic reward probably became redundant. In fact, it is hard to see how one could avoid providing feedback when the breakdown of a complex skill is such that it allows the learner to advance by easy steps which are self-paced and which always begin with what the learner can already do.

The distinction between single units of behaviour and a set of behaviours, each of which has to be learned and then incorporated into the whole, is made clear in the toilet training literature (see Chapter 3). It is possible that the distinction is more than one of complexity in the arrangement of reinforcement, but may involve different processes. The task of changing problem behaviours in humans appears to resemble that of laboratory research, especially when the behaviour to be trained can be treated as one unit. However, when the behaviour to be trained is complex,there are constraints placed on the possible strengthening procedures, in terms of fixed objectives, which do not exist in the laboratory. Therefore, a direct transfer of behaviour strengthening principles from the laboratory is not possible. It may be that factors such as the adequacy of task analysis and the opportunity for practice and overlearning override the operation of extrinsic reinforcement during the building of predetermined sequences in training. Nevertheless, the operation of reinforcement may exert considerable control once the entire sequence is established and ready for the final strengthening and generalization tc take place. This hypothesis was not tested in the study reported here. Further research into maintenance and generalization after training may show that contingent reinforcement becomes essential once toileting can be treated as a unit rather than as a number of discrete responses. In fact, partial support for this hypothesis is already available. A number of investigators have used reinforcement, sometimes in combination with punishment, for accidents in persons who could already perform the self-toileting sequence (Chopra, 1973; Pedrini & Pedrini, 1971; Scott, 1977; Wolf, 1965). In these studies, contingent reinforcement was provided as the subjects went about their usual activities. This approach is akin to the maintenance procedures provided after intensive training of the entire toileting sequence, using either the Azrin and Foxx (1971) or the chaining procedures. A number of authors interested in skill mastery by retarded children in educational settings have similarly differentiated between the acquisition of new skills and the later strengthening and maintaining of already acquired skills (Haring, Liberty & White, 1980; Rosenshine, 1980). Task breakdown, cues, prompts, and various forms of guidance were seen by these authors as the important factors during acquisition, while reinforcement contingencies became important in the later stage.

This study provides little evidence concerning the importance of contingency in the operation of reinforcement, since training with no reinforcement resulted in much the same amount of improvement as when reinforcement was provided, irrespective of the contingency. However, the differential effects of contingent and non-contingent reinforcement on the reduction of accidents during training suggests that contingency was not unimportant.

It was suggested in Section 7.3 that the loud "NO" may have partially lost its aversive properties because it was paired with positive reinforcement as a result of the chaining process. An additional explanation is suggested by the informational view of reinforcement mentioned earlier in this section. In the chaining programme, contingent reinforcement was in fact delivered for retaining a small amount of waste, especially during the early stages of training when no self-initiations occurred. It could be argued therefore that contingent reinforcement worked against the aversive procedure by indicating that the response which required the least effort (partially stopping involuntary voiding) was an acceptable response. Non-contingent reinforcement may have been too far removed from the response to have this effect.

Several other aspects of the results of this study deserve comment. In Study 1, Social Quotient on the Vineland Maturity Scale (Doll, 1936) and age were found to have no influence on the amount of improvement in toileting which occurred during training. These findings were confirmed in the present study. Pre-training toileting ability was also found to be unrelated to improvement, although in the previous study there was a significant relationship. The different procedures used in the two toilet training programmes may account for this discrepancy.

A number of inadequacies in the Azrin and Foxx programme were noted as a consequence of the outcome of Study 1. Several of the essential responses were not adequately taught, and correct sequencing of responses was not always achieved. Therefore, children who had few toileting skills before training were unable to acquire the entire self-toileting sequence. The number of skills which trainees already have may no longer be important once training is directed effectively at each component skill and at the sequencing of those skills. The chaining procedures were specifically designed to do this. Whether they were, in fact, more effective than the Azrin and Foxx procedures, will be considered in Chapter 8.

The results from this study do indicate that the chaining procedures were successful in establishing self-toileting for most of the children. Moreover, this programme is now being used successfully by Intensive Training Unit staff who had no part in the initial development and testing. However, further improvements are necessary in relation to bladder and bowel control skills. Although improvement occurred in these skills, children still did not achieve the level of success which was achieved in the skills not associated with bladder and bowel control. Refinement of reinforcement procedures may not be the answer. Instead, improvement in acquisition may come from a further analysis of the muscle control required, together with more direct cues and the provision of guidance in some form.

This study did not examine procedures to enhance generalization of the skills to real-life settings. Although improvement at follow-up was considerable, many children did not maintain the high level of performance achieved during training. This has been a problem in many toilet training studies (J.M. Gardner, 1969; Osarchuk, 1973). An indication of one direction for future research in this regard is given by the superior skill maintenance at follow-up by children living at home compared with institution children.

CHAPTER 8.

THE CHAINING PROGRAMME: CASE STUDIES AND A COMPARISON WITH THE AZRIN AND FOXX PROGRAMME

8.1. INTRODUCTION

The last chapter was largely concerned with between-group comparisons, and the light which these shed on a number of important theoretical and practical issues. These issues mainly centred around the general factors which affect the acquisition of a complex human behaviour such as self-toileting. However, a second focus of research for this thesis has been to develop a practical training technology which could be used by programme designers and trainers to teach self-toileting to a wide range of incontinent, intellectually handicapped persons.

The problems involved in applying learning principles derived in the laboratory to the training of complex human skills have been outlined in Chapters 3 and 4. In relation to toilet training, few advances have been made since Ellis (1963) first proposed that solutions to the toileting problems of intellectually handicapped persons may come from a learning theory analysis. Instead, the majority of toilet training ventures have been characterized by a reliance on reinforcement notions and ad hoc procedures that has failed to address substantive theoretical issues. Although considerable practical success has been reported, in comparison with the traditional unsystematic methods, this approach has not provided a reliable or generally effective technology which can be used by programme designers and trainers. In fact, the situation has not changed much in relation to toilet training since 1956 when Hilgard and Bower stated: "The lesson to be learned from research on training may be stated in this way: it has been found enormously difficult to apply laboratory-derived principles of learning to the improvement of efficiency in tasks with clear and relatively simple objectives. We may infer that it will be even more difficult to apply laboratory-derived principles of learning to the improvement of efficient learning in tasks with more complex objectives." (p. 542).

The research reported here suggests that the experimental and theoretical literature on learning may provide an appropriate framework for further research directed to this issue. However, the almost exclusive reliance on operant theory may not be justified. Operant research has given little attention to the variables which facilitate the acquisition of complex skills, although behavioural consequences have been assumed to be important (Millenson & Leslie, 1979). The results reported in Chapter 7 suggest that this assumption may not be supported by research. If this is the case, then toilet training researchers also need to look for other variables which may not yet be considered in current learning theories.

Since the early 1960's, applied behaviour analysis, with its emphasis on the importance of data from individuals, has encouraged the search for such variables (Hersen & Barlow, 1976; Lovitt, 1975). Although much of the research in this field has concentrated on reinforcement variables, its emphasis on the analysis of single cases can facilitate the discovery of other controlling variables which may not be predicted by theory.

Experimental design based on the single case has not been used in the research reported here. Nevertheless, an examination of individual cases is useful in any attempt to isolate factors which may increase the general efficacy of training procedures, or point to other variables which may be of importance during acquisition. This examination is especially important since individual variations in response to the chaining programme used in Study 2 were obscured in the group averages. Therefore, in this chapter the individual records of selected children who were toilet trained with the chaining programme will be discussed in detail. In addition, a comparison of this programme with the Azrin and Foxx programme (Foxx & Azrin, 1973b) will be made. Such a comparison can only be tentative, since the conditions and measures used in the studies carried out with the two programmes were not exactly the same. Nevertheless, the chained toilet training programme was specifically designed to overcome some of the inadequacies observed in the Azrin and Foxx procedures. In the search for a general training technology it is important to assess whether the new procedures showed any signs of being more effective.

8.2. CASE STUDIES

All 18 children in ~~this~~ Study 2 could already perform at least some of the skills required for self-toileting (see Chapter 7). The average number of skills already mastered was 3, with a range from six skills for one child (child 14) to no fully mastered skills for three children (Children 5, 6 and 11). However, the particular combination of skills which had not been mastered at baseline differed for each child. In addition, many of the skills which had not been mastered were not totally absent, with children varying in the level at which they performed the unmastered tasks. Thus, some skills were never performed at baseline by a few children, while most children could perform some part of the unmastered tasks without help. The training task in this case was to establish independent performance of all aspects of the tasks. Other tasks were performed by some children to mastery, but only on some occasions. In this case the skill existed in the child's repertoire, but required strengthening and integrating into the entire toileting sequence. The individual cases presented in this section have been chosen in order to show the variety of skill deficits and responses to training.

The first three cases exemplify three different patterns of behaviour during training. The first response involved rapid mastery of the entire self-toileting sequence after training of the first few responses in the chain. The individual case selected was typical of those who successfully completed training within the allotted time. The second followed a similar pattern, but progress was erratic and was often disrupted by procedural changes. This pattern was typical of the three children who were self-initiating by the end of training, but who did not reach criterion in the allotted time. The third response involved steady but slow progress through each phase, typical of the five children who did not self-initiate frequently enough to transfer to phase VII. They required training in each element of the sequence and may have reached the criterion if training had been continued for several more weeks.

The fourth and fifth cases illustrate two specific deficits which were not analysed during the design of the chained toilet training programme. Although these deficits were rare, they involve aspects of bowel or bladder control which are crucial to self-toileting. The last two cases are of children who achieved mastery during baseline. Their performance raises issues concerning baseline and maintenance procedures.

8.2.1. Explanation of the Figures in this Chapter

The data for individual cases are presented in the form of Figures showing performance on the particular skills through the several phases of the study, described in Chapter 7. During training, phases I, II, IV, V and VI taught the skills of pants up, standing from the toilet, seating self on the toilet, pants down and toilet approach in that order. During each phase, only those skills which were being taught, or which had already been mastered, were practised. Those skills remaining to be taught were carried out as much as possible for the child. For instance, the pants were pulled down by the trainer or the child was placed on the toilet or physically led to the toilet by the trainer. This was so both during trials and when toileting occurred in between trials during phases I and II. From phase III on, each toileting constituted a trial. Throughout training, self-initiations were allowed and recorded, but all other toiletings occurred during trials or after accidents and the tasks other than those being taught were carried out by the trainer.

Figures showing the five tasks which did not involve bladder or bowel control reflect this procedure. There was no opportunity for improvement in the skills which were not being practised during a particular phase, except when self-initiations occurred. The programme was designed in this way to ensure that each element in the toileting sequence was performed in its correct place in the sequence and only after the elements which came before it were mastered. However, the possibility of self-initiating at any time during training provided opportunities for the children to construct the sequence for themselves. There were occasional unsuccessful attempts at self-initiation which were not recorded. During these attempts, the child was taken out of the toilet area as soon as an incorrect response occurred or performance ceased. During all phases, toilet voidings, toiletings which did not result in voiding, accidents, self-initiations, time taken to void in the toilet and accident size were recorded. Hence, improvement on these measures throughout training could be followed. The reader may wish to refer to the description of each training phase in Section 7.2.5 during the following discussion of individual cases.

8.2.2. Rapid Mastery of self-toileting

Child 9 in the non-contingent reinforcement group was one of 10 children who successfully completed training within the allotted time of 34 days. He was typical of these children in that he did not progress through all seven training phases, but began to toilet himself frequently enough during phase IV to be transferred to phase VII. Transfers to phase VII part-way through training occurred for 13 of the children, but three had not completed phase VII on day 34. The jump to phase VII occurred during phases III to IV.

The performance of child 9 illustrates this. Figure 8.1 shows his performance on the five tasks which did not involve bladder or bowel control. The baseline scores show that seating self on the toilet had been mastered before training. The remaining four were sometimes performed correctly, but performance was unreliable. Thus, child 9 had the skills required for all five tasks in his repertoire, but these skills had not been reliably integrated into the toileting sequence. Figure 8.1 shows each skill improving as it was added to the sequence. However, this child began sitting independently during phase III, before the trainer could do it for him, and before it was the target of training. This was the skill which had been mastered before training. During phase IV he began to self-initiate (see Figure 8.2). Self-initiations, by definition, were toiletings during which every task was carried out correctly. Thus, the improvement in pants down and toilet approach shown in Figure 8.1 during phase IV (which taught sitting) occurred because self-initiations were increasing in frequency. During phase IV, child 9 reached the criterion for proceeding to phase VII. Therefore, phases V and VI were omitted. During phase VII the variations in toilet approach, shown in Figure 8.1, reflect the occurrence of voiding accidents. These accidents resulted in the loud "NO" and the minimum prompt required to induce toilet approach.

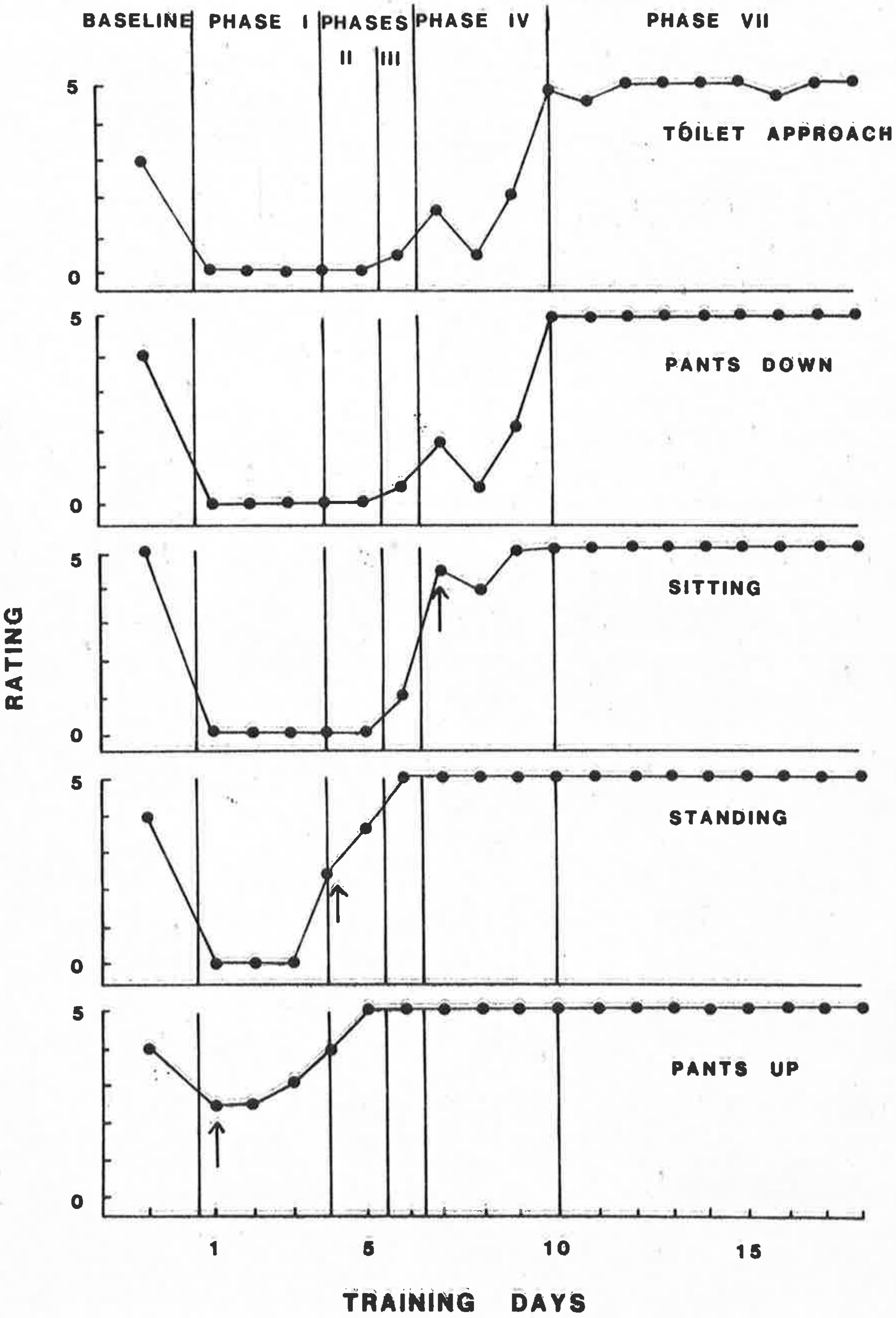


Figure 8.1. Performance of child 9 in the five tasks which were not associated with bladder or bowel control. Arrows show when training of the particular skill began.

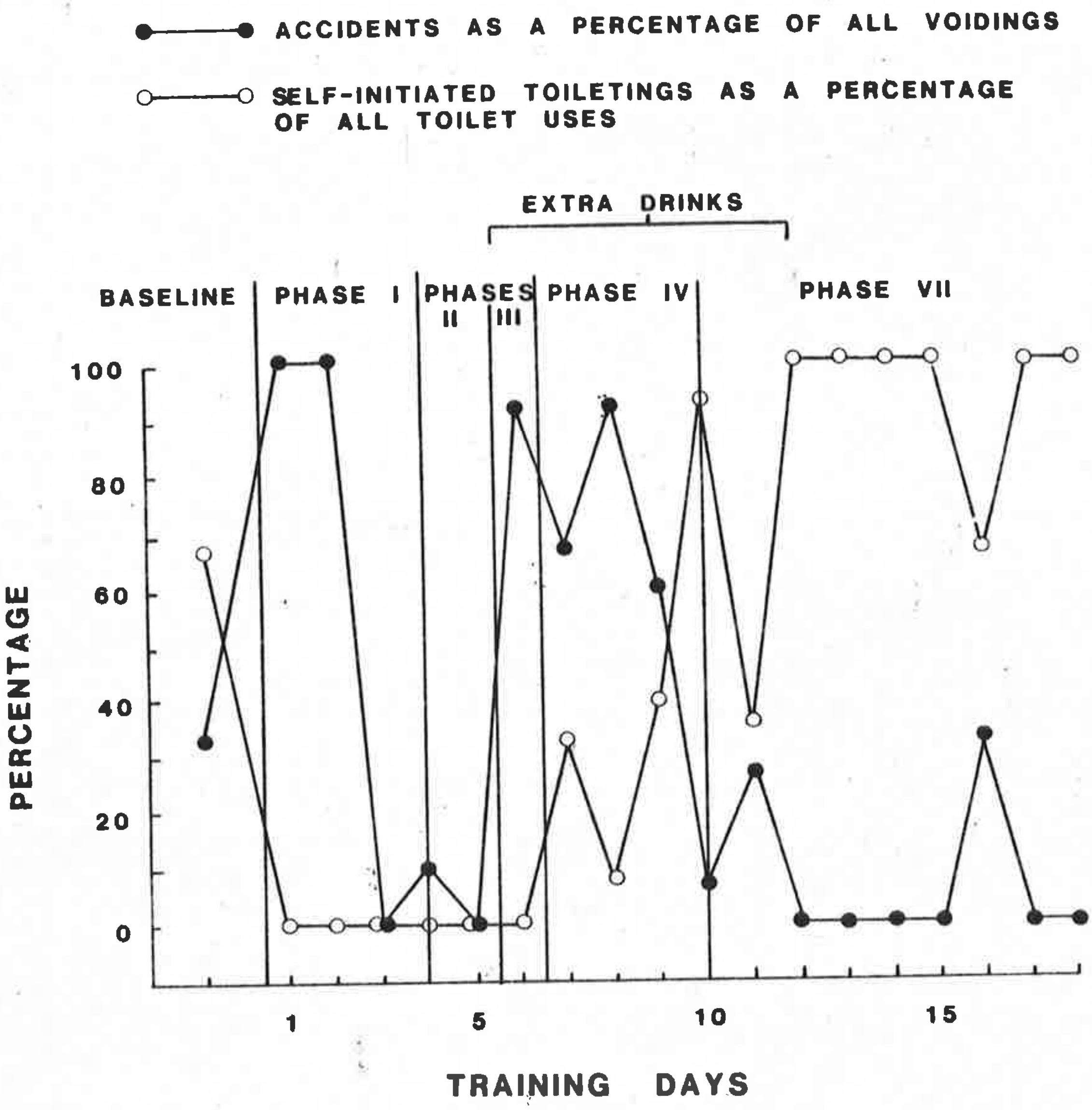


Figure 8.2. Changes for child 9 in voiding accidents and self-initiated toileting.

Throughout baseline and training, all toiletings by this child resulted in immediate voiding. Consequently, it was assumed that the muscular skills required to bring about toilet voiding had been thoroughly mastered before training, and these measures are not shown. However, voiding accidents constituted 33 percent of all voidings at baseline, and the same proportion of all toiletings required some prompting or guidance from the trainer (Figure 8.2). As was the case for four of the tasks shown in Figure 8.1, child 9 had the skills required to prevent accidents and toilet himself, but these were not performed reliably.

During phases I and II accidents decreased (see Figure 8.2), largely because child 9 began to void during the training trials even though this was not required. Once extra drinks were given every half hour, the accident rate increased. However, as self-initiations subsequently increased, accidents again decreased until, with the exception of one day, child 9 was consistently self-initiating and accident-free over the last seven training days. This indicated that recognition of sensations of bladder and bowel tension and perineal tensing to prevent voiding outside the toilet were occurring, and that the entire toileting sequence had become established as a unit.

Tensing the perineal muscles to stop voiding after an accident had begun was not so successfully learned. This was the skill least well taught by the chaining programme. Figure 8.3 shows the performance of this skill as reflected by ratings of accident size. The zero points in this figure occurred on days when there were no accidents (refer to Figure 8.2). An examination of the remaining points on the graph show a decrease in accident size during phases I and II, after an initial increase. With the introduction of extra drinks there was another increase, then a slight decrease, until accidents ceased altogether.

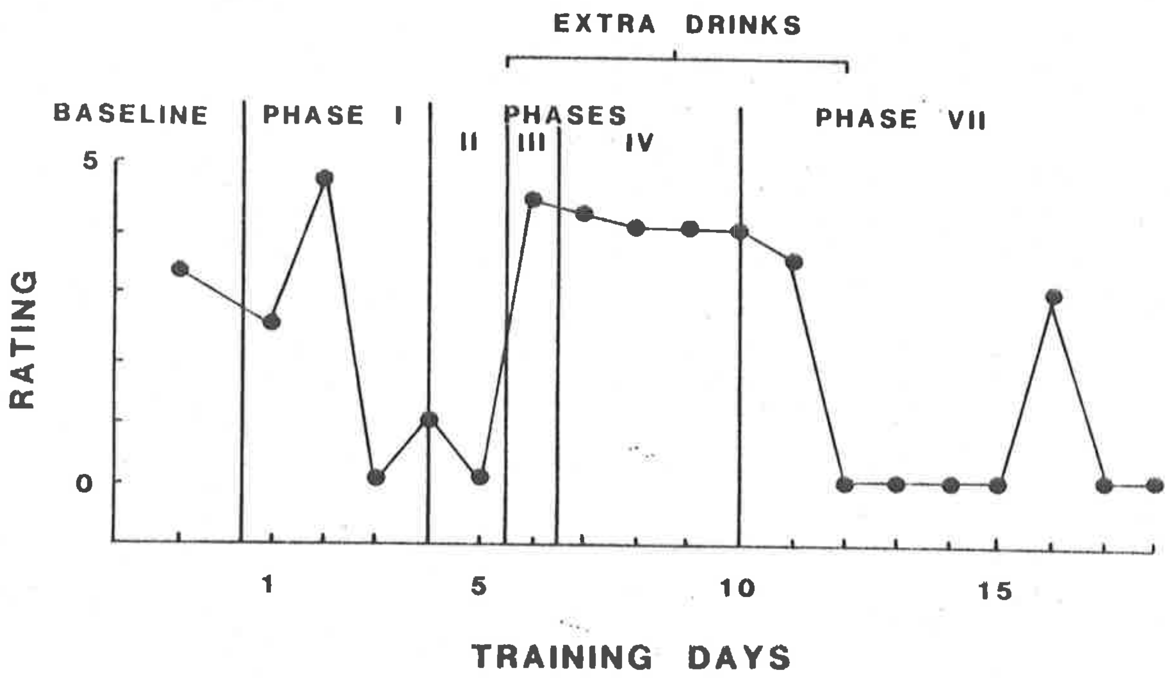


Figure 8.3. Changes in the size of accidents during training for Child 9.

It may be that this is a skill which is not easily learned, no matter what training techniques are used. Many non-handicapped adults who have no toileting problems report difficulty in interrupting the urine flow until towards the end of the stream. Only further research will indicate whether this skill could be acquired more efficiently, or even whether it contributes in any way to efficient self-toileting.

8.2.3. Erratic progress during training

Child 6, in the contingent reinforcement group, was one of the three children who did not complete training, but who began toileting themselves frequently and who were therefore transferred to phase VII. Her performance was typical of this group.

Figure 8.4 shows her performance on the five tasks which did not involve bladder or bowel control. Although none of these skills had been mastered before training, all but seating self on the toilet and toilet approach were performed correctly without help on some occasions during baseline. Thus, child 6 had three of these skills in her repertoire, but they were not reliably cemented into the toileting sequence. The first two skills of pants up and standing improved quickly and smoothly during phases I and II, while pants down was not directly taught since it began to be performed to mastery as self-initiations increased during phase IV. This is a similar pattern to that shown for child 9 in Figure 8.1.

Child 6 needed considerable help to seat herself on the toilet (see Figure 8.4). She was a small child of four, and had been used to sitting on a pot at home and at pre-school. During phase IV, she required careful guidance of her hands and buttocks until she learned to hoist herself on the seat and then shift back until she was in the correct position for voiding. Therefore, she required more training time for this skill than child 9, who could already seat himself before commencing training (see Figure 8.1).

During phase IV, child 6 reached the criterion for proceeding to phase VII. The improvement and variation in toilet approach during these two phases largely reflects the occurrence of self-initiations and voiding accidents, since this skill was mastered without direct training. The drop in performance of toilet approach, pants down and sitting during a return to phase IV occurred because the task was either being carried out by the trainer, or, in the case of sitting, was being prompted and guided during most toiletings. The return to phase IV will be discussed in more detail later.

During baseline, the majority of voidings were accidents, less than half of all toiletings resulting in voiding, and no self-initiations occurred (Figure 8.5). Inducing voiding in the toilet presented considerable difficulty. Child

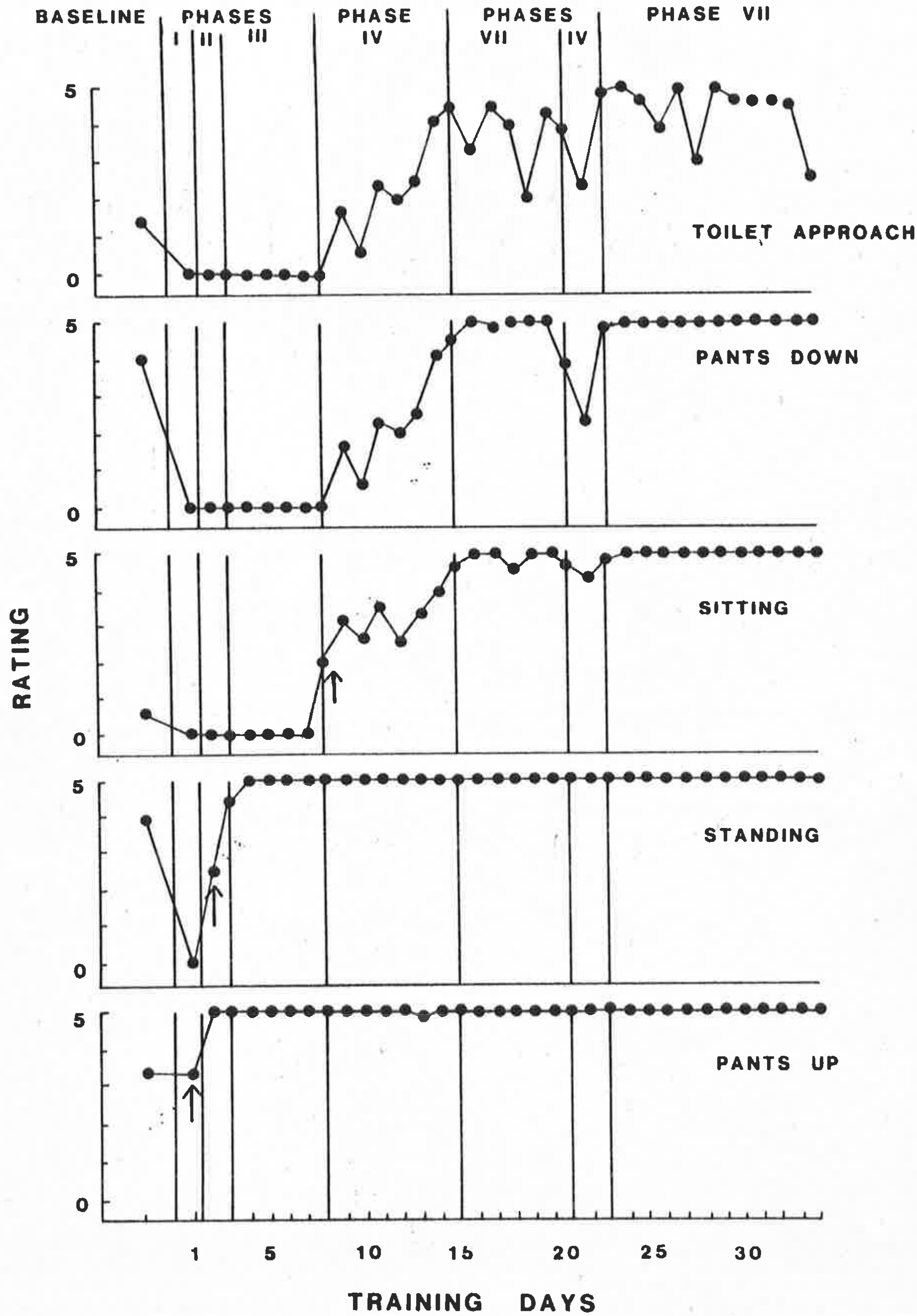


Figure 8.4. Performance of Child 9 in the five tasks which were not associated with bladder or bowel control. Arrows show when training of the particular skill began.

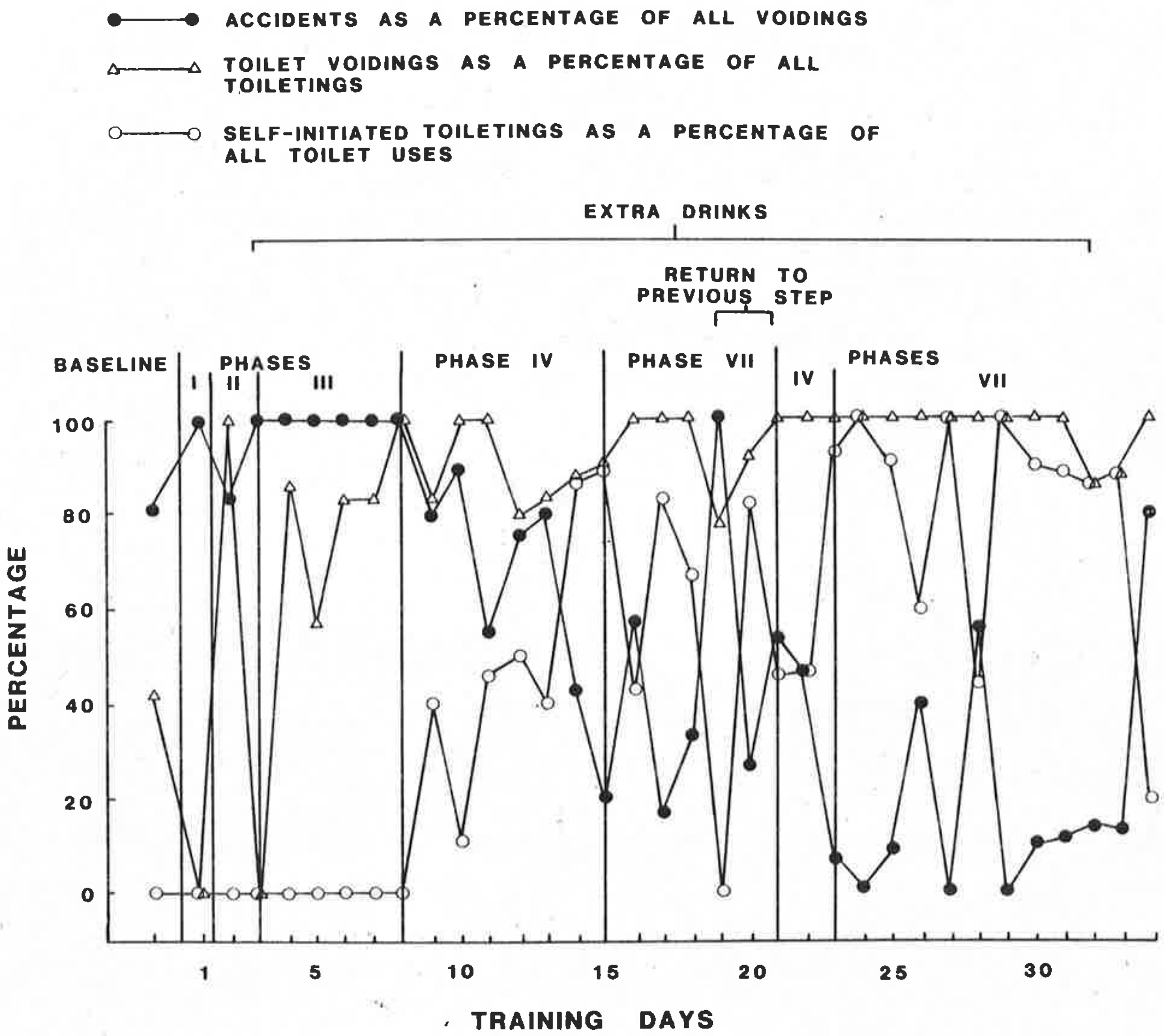


Figure 8.5. Changes for Child 6 in voiding accidents, toilet use, and self-initiated toileting.

6 was a very active child who concentrated on one activity for no more than a few seconds. She was rarely still unless kept constantly amused. When required to comply for more than a few seconds, she struggled, cried, and often kicked, screamed and threw herself about. Consequently, sitting on a chair was shaped from three seconds to five minutes during baseline, and three minutes in an empty room were made contingent on tantrums.

These procedures were successful in eliminating non-compliant behaviour. However, once phase III began, tantrums began to occur whenever she was guided to remain on the toilet for more than a few seconds. Since she had not learned to start voiding immediately she was on the toilet, guidance to remain seated occurred during every toileting on the first day of phase III. Trainers dealt with this by using continuous guidance which blocked all movements away from the correct sitting position. This was a very tiring procedure, but during the next two days tantrums decreased and the number of voidings during toiletings increased. From day six no further tantrums occurred.

From day 5, child 6 gradually mastered the muscle control required to void immediately at every toileting (Figure 8.6). This was a skill which child 9 did not have to learn, and therefore the time required for child 6 to complete training was further lengthened.

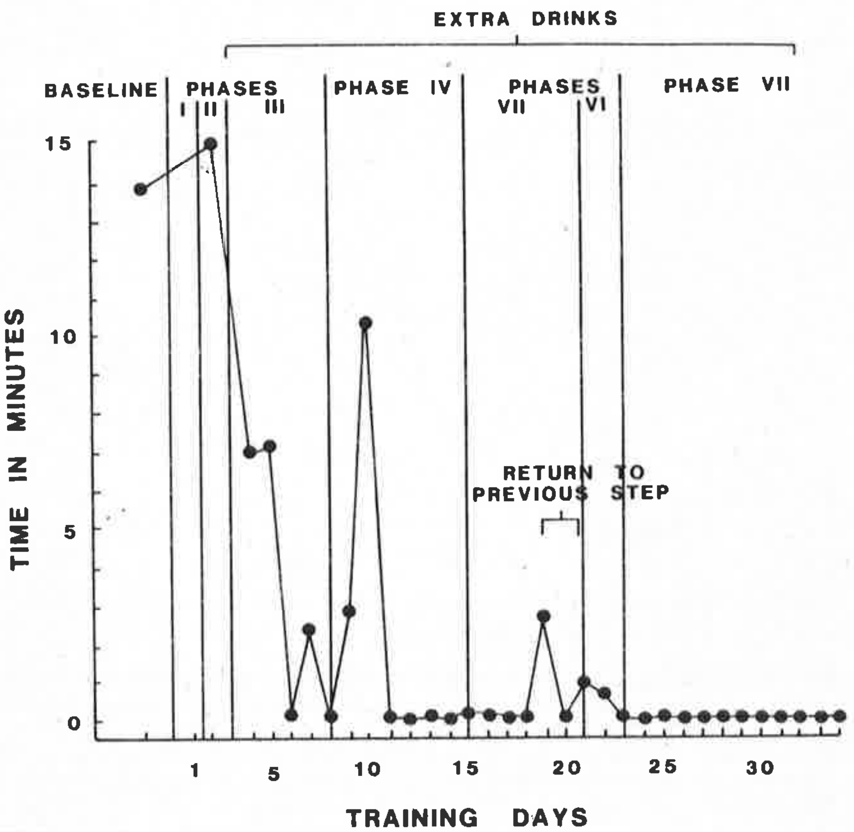


Figure 8.6. Changes for Child 6 in the time taken to initiate voiding in the toilet.

Accident rate and self-initiations also gradually improved during training, although these measures were clearly disrupted by changes in procedure. For instance, on the fifth day of phase VII, these two measures deteriorated (see Figure 8.5). This occurred because child 6 was moved to sit outside the bathroom door so that she could no longer see the toilet. She was moved back within sight of the toilet and performance improved, but deteriorated again on the seventh day of phase VII. Consequently, phase IV was reintroduced. After three days in phase IV, child 6 again transferred to phase VII and movement away from the toilet was implemented more gradually. This time the improvement in accident rate and self-initiations was maintained until day 26, when she was again placed outside the bathroom door. However, performance recovered without further breakdown in the steps. It deteriorated again when free movement and play were allowed, and again recovered when the area in which she could move was restricted. These restrictions were gradually withdrawn and performance on these two measures approached mastery until the final day when outer clothing was introduced (see Figure 8.5). Several days of training to manage these would probably have resulted in performance to criterion. In fact, this training was successfully provided by the child's mother during the first few maintenance days.

Child 6 improved more than child 9 in tensing the perineal muscles to stop voiding after an accident had begun. This skill was represented by ratings of accident size (Figure 8.7). It is possible that the more frequent accidents experienced by child 6 enabled more effective acquisition of this skill. However, it was not established to the point where accidents involved no more than a few drops or a smear on the pants.

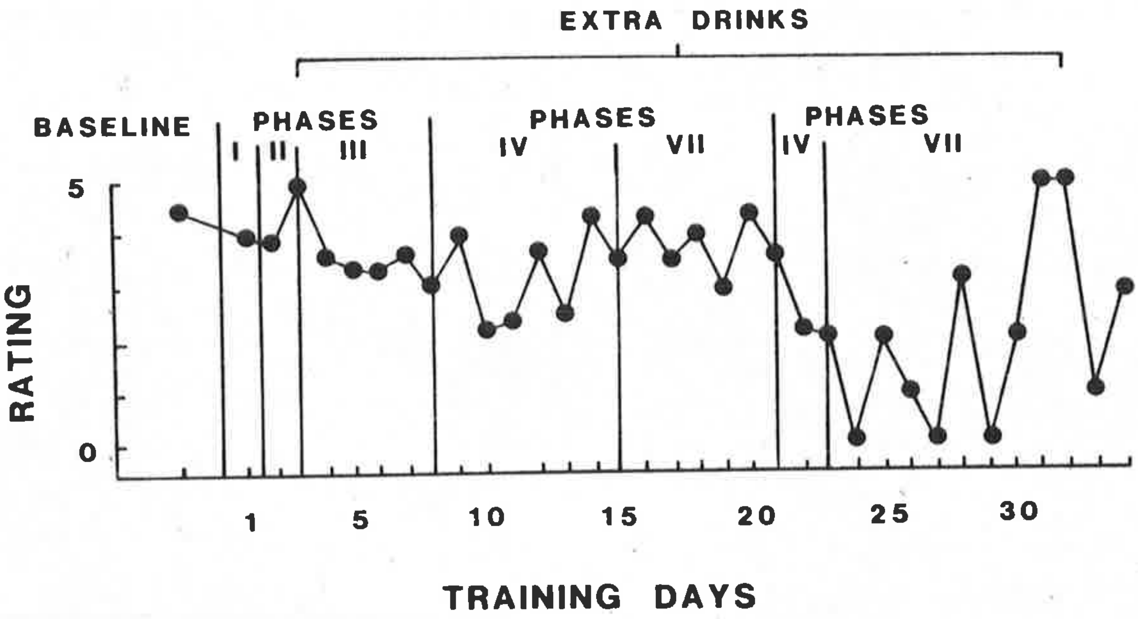


Figure 8.7. Changes for child 6 in the size of accidents during training.

In general, child 6 had fewer skills at baseline than child 9. Her performance during training was more erratic, improvement was slower, and was more susceptible to disruption by changes in procedure. She also required a longer maintenance time than child 9 (133 days as compared with 46 days). However, there were additional gains made by child 6. Her mother reported that temper tantrums rarely occurred at home after the first few days of training. In addition, the mother acquired improved child management methods and greater confidence in herself and her child. Furthermore, the periods of sitting in a chair between trials appeared to increase the child's ability to concentrate and thus learn. She learned to recognize many more pictures, complete simple manipulative toys and join in action songs. These were some of the activities provided between trials. Her mother reported that child 6 had begun to spend between 5 and 30 minutes looking at picture books at home without adult direction. It would seem that the longer training time and the more erratic pattern of improvement reflected fewer toileting skills in child 6's repertoire prior to training.

8.2.4. Training required of all elements in the toileting sequence

Child 7, in the non-contingent reinforcement group, was one of the eight children who did not complete training in the allotted 34 days. Although she began to toilet herself during training, she did not do this often enough to transfer to phase VII. Instead, she steadily progressed through the training phases. Her performance in this regard was typical of the five children who did not reach phase VII. Although the baseline ratings of the five tasks which were not associated with bladder and bowel control varied considerably for these children, they all had both a high accident rate and no self-initiations during baseline. These deficiencies appeared to be the consequence of failure to recognize bladder and bowel tension, inability to prevent involuntary voiding and an absence of any attempt to put the entire toileting sequence together, leading to the slower progress during training.

Child 7 had previously mastered the skills required to stand, seat herself on the toilet and pull her pants down (see Figure 8.8). Like the previous two children, she progressed quickly through the phases which taught pants up, standing and sitting. Although pants down had apparently been mastered before training, the acquisition of this skill took considerably longer during training. This was due to difficulty in holding back voiding while the pants down response was being practised, rather than to an inability to pull her pants down. Because of this problem, voiding while on the toilet and the pants down response began to deteriorate (see Figures 8.8 and 8.9). Consequently, on day 18, three pants down trials were introduced every half hour, in addition to the usual toileting trials, in order to increase the speed and confidence with which this task was performed. By day 23 the pants down response was improving steadily and voiding was occurring in

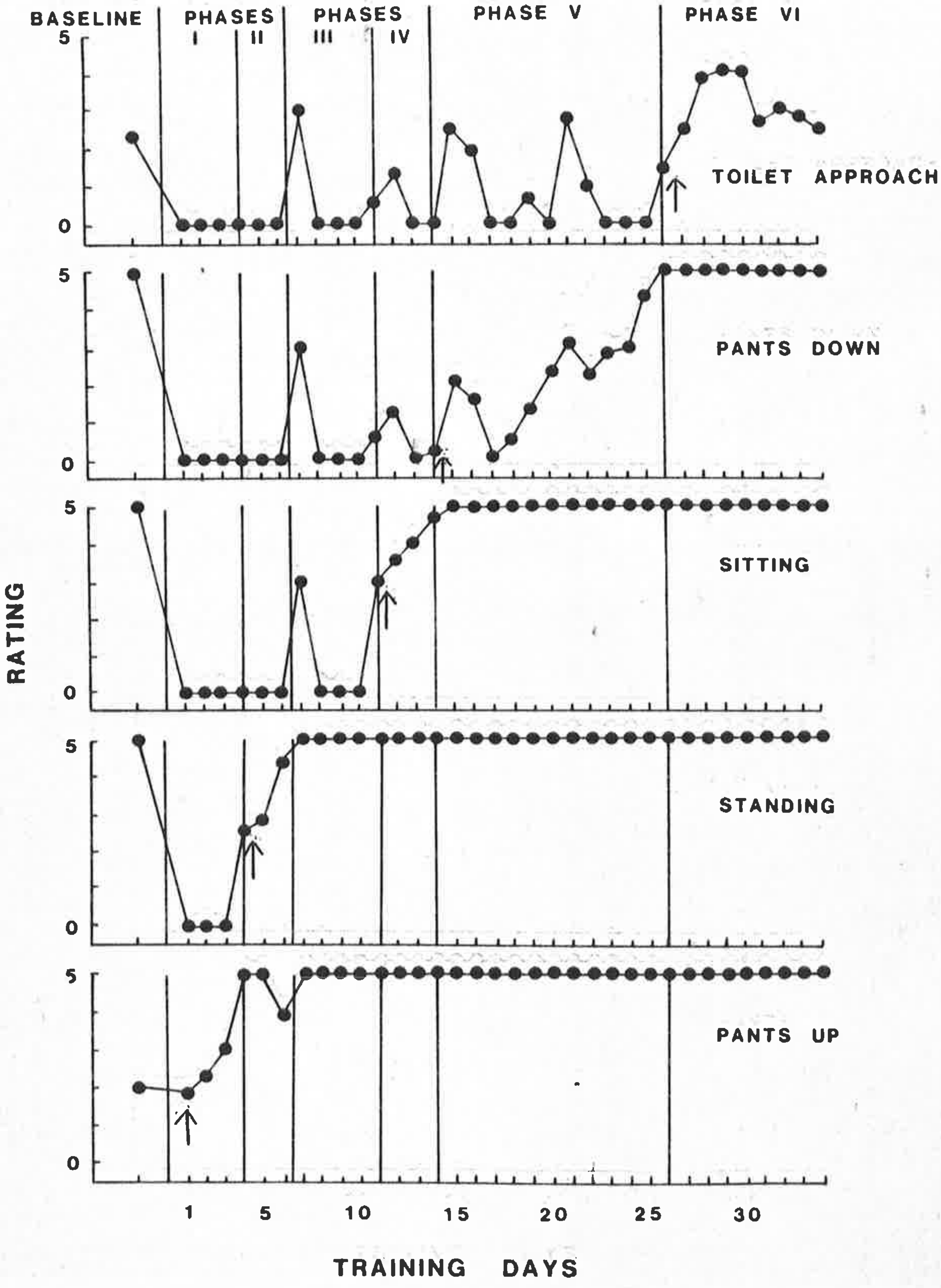


Figure 8.8. Performance of child 7 in the five tasks which were not associated with bladder or bowel control. Arrows show when training of the particular skill began.

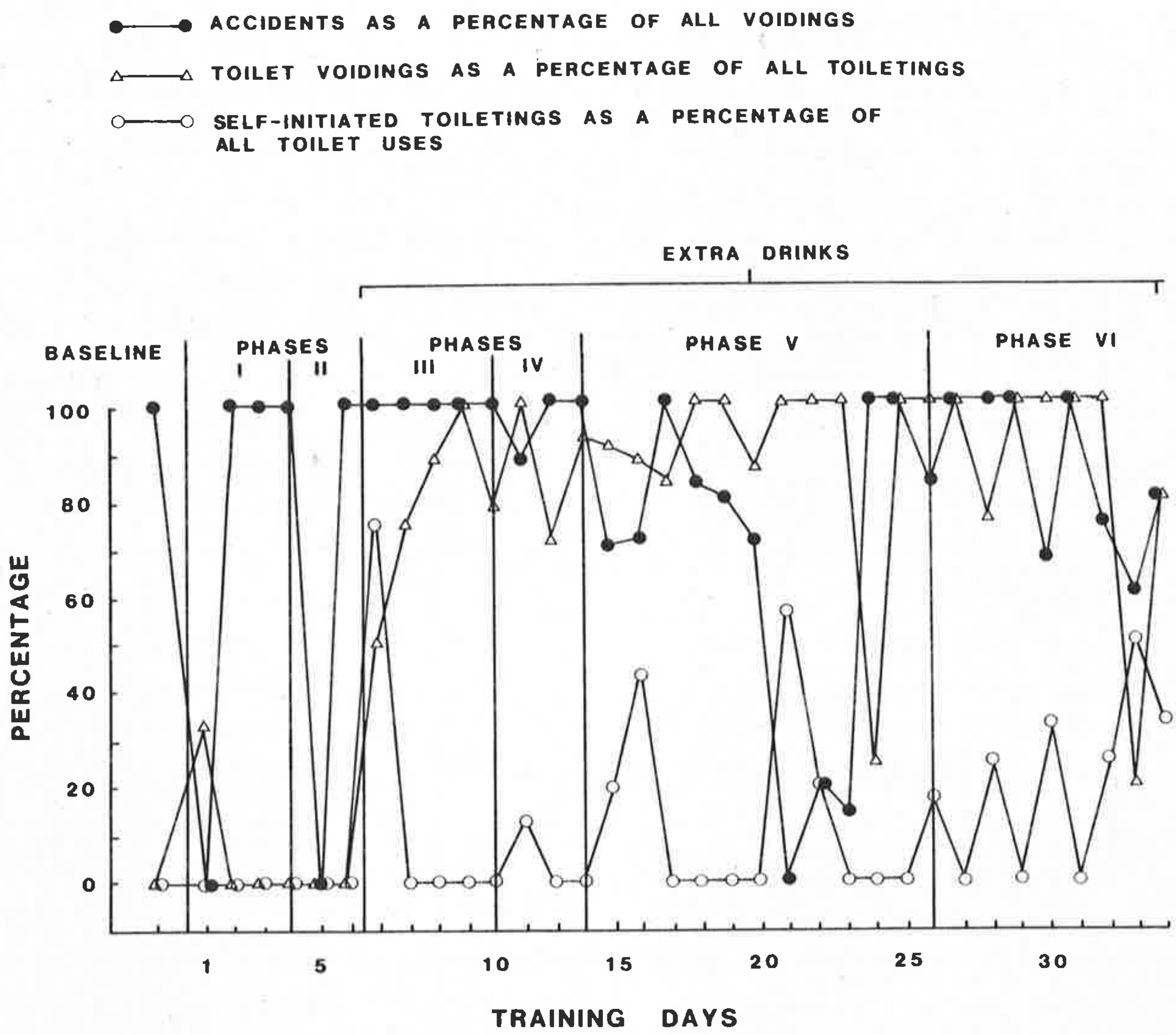


Figure 8.9. Changes for child 7 in voiding accidents, toilet use and self-initiated toileting.

the toilet on almost every trial. The extra trials were discontinued and thereafter pants down continued to improve until child 7 was able to progress to phase VI on day 26.

Independent pants down and toilet approach responses occurred from phase III onward during self-initiations (see Figures 8.8 and 8.9). Once phase VI began, the improvement in toilet approach proceeded more rapidly since this was the training target for that phase. However, improvement was erratic. As with pants down, this probably reflected the disruption caused by attempting to hold back voiding while the toilet approach response was being practised, rather than difficulty in learning this skill. Additional half-hourly trials for toilet approach should also have been introduced at this stage because performance deteriorated over the last four training days, as shown in Figure 8.8. This could not be tried since training ceased on day 34.

The changes in voiding patterns are the crucial factors which differentiate this child from child 9 and child 6. The five measures which reflect these patterns are represented in Figures 8.9, 8.10 and 8.11, and need to be considered together. All voidings were accidents during baseline and phases I and II (see Figure 8.9). However, once toilet voiding became the training target in phase III, the pattern of voidings changed. Figure 8.10 shows that, from this point, child 7 gradually improved her ability to stop involuntary voiding after it had begun, as indicated by a decrease in

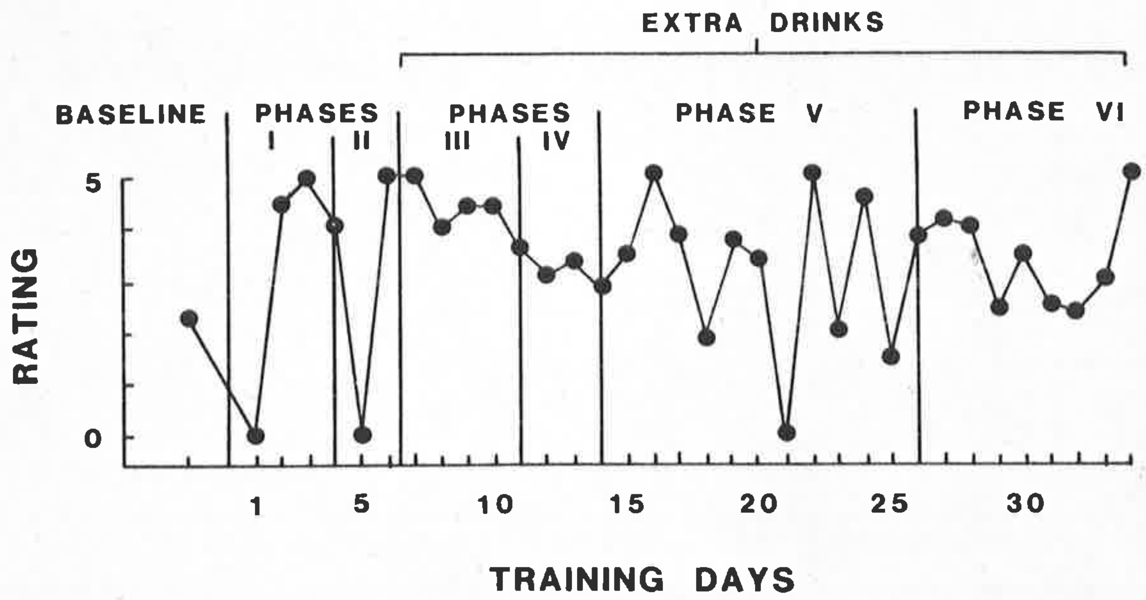


Figure 8.10. Changes for Child 7 in the size of accidents.

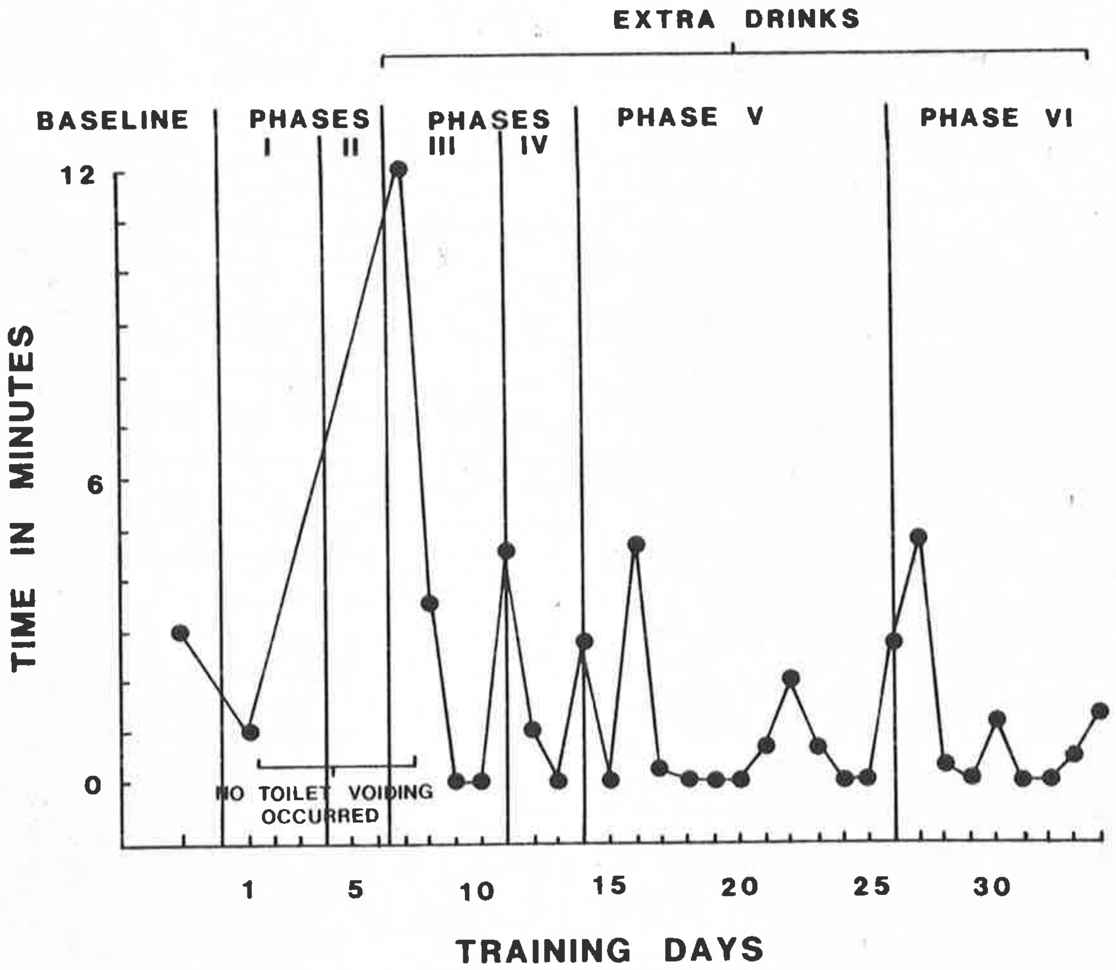


Figure 8.11. Changes for Child 7 in the time taken to initiate voiding in the toilet.

accident size, thus leaving some waste to be voided in the toilet. Consequently, the number of toiletings which resulted in toilet voiding gradually increased. Moreover, the time before voiding began after the child was seated gradually decreased after the initial peak when extra fluids were introduced (Figure 8.11). Similar peaks in this measure occurred at the introduction of each new phase, but performance settled back to a gradually improving rate after each peak.

Accident rate took longer to reduce (Figure 8.9), but with the introduction of half-hourly pants down trials, rapid improvement followed. As soon as the extra trials stopped on day 23, accident rate returned to a high level, but began to decrease gradually again in phase VI, during the last five training days. This indicated that the ability to detect bladder or bowel tension and respond by tightening the perineal muscles was gradually improving, albeit erratically. There was also a very small downward trend in accident size, reflecting some improvement in the ability to stop involuntary voiding after it had begun (Figure 8.10). Self-initiations began occurring after the introduction of phase III, but improvement was erratic until phase VI, when it settled into a slow, steady upward trend.

Child 7 was transferred to a modified maintenance programme designed to generalize the skills learned during training to her living environment in the institution. She was not expected to initiate toileting, but was regularly directed to the toilet with a gesture, after which she carried out the rest of the toileting sequence herself. Maintenance was continued for 180 days and at the end of that time her performance was compared with her performance in the institution before training. Table 8.1 shows some improvement in those measures which were recorded. However, assessment

TABLE 8.1. Child 7: Average number of accidents and toilet voidings per day, and self-initiated toiletings as a percentage of all toilet uses over a seven day period, two weeks before training and during the last week of maintenance.

MEASURES	TWO WEEKS BEFORE TRAINING	LAST WEEK OF MAINTENANCE
Average accidents per day	1.1	0.7
Average toilet voidings per day	0.0	3.7
Percent self-initiated toiletings/total toilet uses	0.8%	15.0%

on the Balthazar day time toileting scale indicated that this improvement had not been maintained at follow-up 12 months after the end of maintenance. The problems of maintaining skills in an institutionalized environment discussed in Chapter 7 were particularly evident in this case. Child 7 lived with a group of very difficult children who were all incontinent. The group was regarded by staff as "hopeless", and they needed more supervision than usual to ensure that the maintenance programme was carried out. There were no good toileting models among the children, and staff were not used to allowing the children to carry out even simple tasks independently. Staff reverted to this practice with child 7 after the maintenance procedures were withdrawn, hence the poor maintenance of skills in this case.

It is probable that, with a considerably longer period of training, child 7 would have achieved the training criterion. However, a more detailed analysis of the muscle action required in bladder and bowel control and more direct training procedures for these skills may have allowed her to learn these skills more quickly and with less errors. Such an analysis is an important research task if training in self-toileting is to be extended successfully to those retarded persons who have few or no bladder and bowel control skills.

8.2.5. Urinary Frequency and Low Bladder Capacity

Child 14, in the no reinforcement group, could perform all five tasks not associated with bladder and bowel control. During baseline she performed two of them correctly at every toileting, and the remaining three during nearly all toiletings. She always voided immediately she was seated on the toilet, toileted herself frequently and, when she did have accidents, voided only small amounts of urine. Her baseline record was, in fact, better that most of the ten children who reached the training criterion in the alotted time. However, child 14 had a history of frequent urination in the natural environment as well as frequent small urinary accidents and voiding of only small amounts of urine in the toilet. One other child displayed this problem (Child 1). In both cases extensive medical examinations indicated no disease or malfunction which would account for this pattern.

Figures 8.12, 8.13 and 8.14 illustrate the problem. Whereas the number of voidings throughout baseline during the six and a half hour day ranged from 1 to 6 for all other children, child 14 voided 8 times on each day (Figure 8.12). The frequency at home was even greater according to her

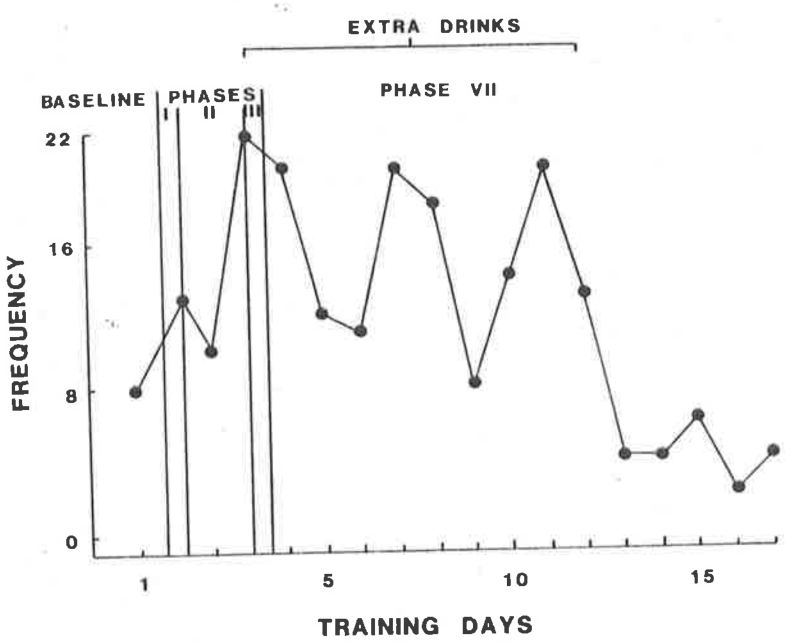


Figure 8.12. Frequency for Child 14 of urinations.

mother. The impact of this voiding rate on daily life is shown more graphically by the time between urinations. The average during baseline was 55 minutes (Figure 8.13), with the shortest time being 5 minutes. Her

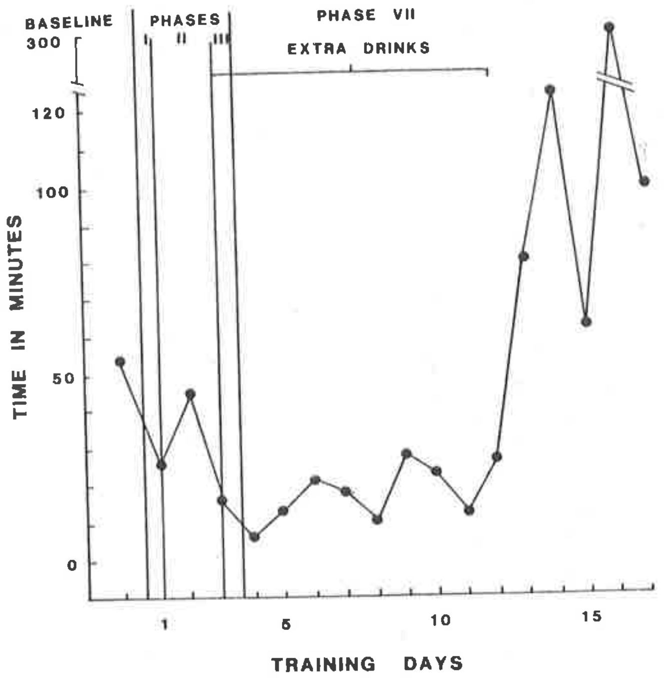


Figure 8.13. Average time for Child 14 between urinations.

mother reported that most urinations at home were only 10 to 20 minutes apart. The higher rates reported by the mother may have reflected her own magnification of a problem which she found extremely distasteful and worrying. They could also have reflected her method of handling the problem. It is highly likely that the mother's anxiety about her child's accidents led her to make frequent comments and give frequent toileting directions. In contrast, trainers paid little attention to toileting or accidents during baseline other than to record or change wet pants, and did not mention toileting at any other time. Nevertheless, baseline records indicated that child 14 urinated more frequently than the other children in this study.

Once training began, urinary frequency increased (Figure 8.12). With the introduction of extra fluids on day 3 there was a further increase to an average of 16 urinations a day. This was a much higher rate than usual. Most children voided 8 times a day on average while extra fluids were

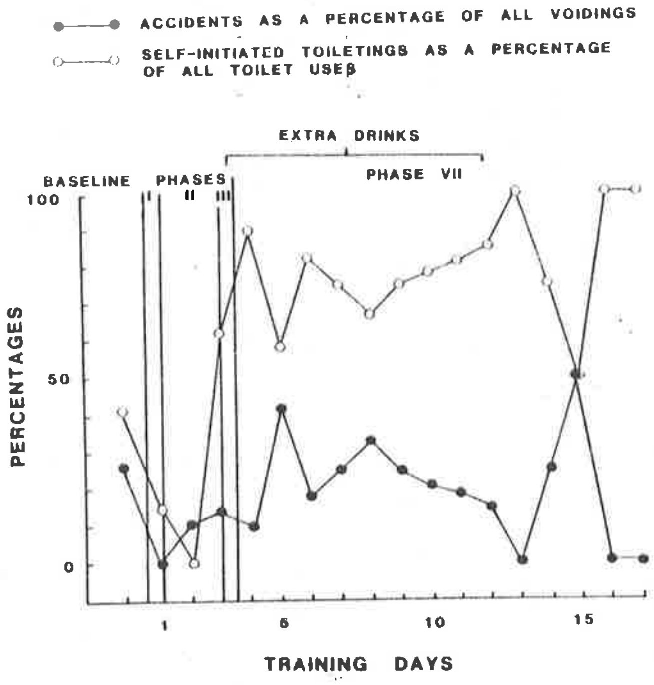


Figure 8.14. Changes for Child 14 in voiding accidents and self-initiated toileting.

provided. From phase III on, self-toileting increased and accidents decreased (Figure 8.14). There was also a slight increase in the time between urinations (Figure 8.12). However, once the extra fluids were withdrawn, the number and spacing of urinations settled into the pattern followed by children with no frequency problem (Figures 8.12 and 8.13). In addition, trainers reported that child 14 was voiding larger amounts in the toilet. The training criterion was reached on day 17 and the maintenance programme was started. The improved voiding pattern continued during maintenance, which was completed to criterion.

Urinary frequency and low voiding volumes have been cited as indicators of low functional bladder capacity (MacKeith, Meadow & Turner, 1973). Comparisons of non-handicapped children over four years of age have shown that many day and night time wetters void smaller volumes of urine and void more frequently than non-wetters of the same age (Esperanca & Gerrard, 1969; Hallgren, 1956; Hallman, 1950; Linderholm, 1966: Muellner, 1960a, 1960b; Starfield, 1967; Troup & Hodgson, 1971; Vulliamy, 1956; Zaleski, Gerrard & Shokier, 1973). A number of investigators have considered low bladder capacity to be a primary factor in many cases of incontinence and have investigated behavioural methods aimed at increasing bladder capacity as a means of reducing wetting (Doleys, 1977). Usually, it has been bed-wetting that has been the ultimate target of treatment, although day time wetting has also been involved in some cases (Fielding, 1980; Hägglund,1965).

The children trained in these cases could already perform the other elements of the toileting sequence. The elements lacking were those which would allow increased quantities of urine to accumulate in the bladder before the urge to void was heeded. Muellner (1960a, 1960b) has suggested that most children spontaneously learn to manipulate the voluntary muscles of the pelvic floor and abdominal wall in order to inhibit or initiate the act of micturition (passing urine) at will. It is possible that this voluntary muscle control in the presence of the urge to void, at least partly, allows the urge to be delayed and the involuntary escape of urine to be prevented as an increasing volume accumulates in the bladder. Thus, older children and adults experience the urge to void less frequently than young children, and pass larger amounts of urine when they do void. Those who fail to develop the use of these muscles are left with an inadequate bladder capacity and incomplete urinary control, resulting in frequent urination of small amounts and occasional involuntary voiding.

Low bladder capacity has emerged as a distinct deficit in some children who have otherwise mastered all other toileting skills. However, incontinent intellectually handicapped persons are usually deficient in a number of toileting skills, and low bladder capacity as a specific deficit requiring systematic training has not been considered. Consequently, the design of the chaining programme used in this study did not include an analysis of bladder capacity, and no specific measures were devised to reflect it. Nevertheless, the data which were available in the baseline and training records indicated that low bladder capacity was the major deficit for child 14, and suggest that systematic analysis and training to increase bladder capacity may be a necessary part of toilet training in some cases.

The reduced voiding frequencies achieved by child 14 by the end of training suggest that the chaining programme did increase bladder capacity. An aspect of this programme that has been shown to increase bladder capacity in non-handicapped children is the ingestion of extra fluids. As in the Azrin and Foxx procedure (1971) the chaining programme provided extra drinks every half hour during training.

Hagglund (1965) showed that this procedure alone can increase bladder capacity considerably. A series of 46 non-handicapped children were admitted to a children's psychiatric ward and allocated to three groups. One group was encouraged to drink plenty of fluids during the day. A second group was treated by restricting fluids in the evening and awakening to go to the toilet at night. A third group acted as a control and received no specific treatment other than supportive handling during their stay. Cystometric measures of bladder pressure at the first desire to void and with a full bladder were taken before and at the end of three months' treatment.

The control group improved on all measures, 7 of the 16 children wetting less frequently. The amount required to fill the bladder increased by an average of 10 percent and the volume at which the urge to void appeared also increased by 10 percent. However, additional fluids led to greater improvement. Six of the 18 children in this group stopped wetting altogether and 7 were wetting less. In addition, average increases in the two bladder capacity measures were 20 percent and 27 percent respectively. These measures actually decreased in the restricted fluids groups, and only two children in that group were wetting less by the end of training. It would appear from these results that bladder capacity can improve in a supportive environment without specific training. However, extra fluids extended this improvement to the point where involuntary wetting could be prevented. In addition, the consequences of restricting fluids which were observed in this study accord with urological findings that keeping the bladder empty reduces the volume at which the desire to void occurs (Yeates, 1973). The sudden improvement in voiding frequency and time between voidings in comparison with baseline for child 14 after extra fluids were withdrawn suggests that the extra fluids were also an important factor in this case (see Figures 8.12 and 8.13). However, controlled trials are needed to establish whether similar improvement will occur for other intellectually handicapped persons with low bladder capacity.

Factors other than extra fluids discussed above may also be important to bladder capacity. Inadequately learned muscle control may be one such factor. The child first learns to discriminate the sensations which indicate a full bladder, and then to contract the perineal muscles so that the escape of urine is prevented and the detrusor (the smooth muscle of the bladder wall) ceases contracting and relaxes (MacKeith, Meadow & Turner, 1973; Muellner, 1958, 1960a; Vincent, 1960). Muellner (1958) postulated that, in the absence of neurological or physical abnormalities, low bladder capacity is the result of imperfect acquisition of this control. Thus, while increased fluids may extend the elasticity of the bladder, adequate control in the presence of larger bladder volumes also requires direct training of perineal muscle contraction.

The accident procedure in the chaining programme and in Mahoney's study (1973) provided some training in this skill. The onset of involuntary voiding in the pants sounded the pants alarm. The trainer immediately shouted "No", thus startling the child into shutting off voiding. It can be assumed that children who began to toilet themselves before involuntary voiding occurred had learned to discriminate the urge to void and to contract the perineal muscles long enough to get to the toilet. However, this procedure did not induce perineal tensing for the long periods required to extend bladder capacity and thus reduce the frequency of urination or increase the amount voided at one time. It is reasonable to assume that direct training in extended perineal contraction may be necessary to achieve this.

A procedure called retention control training has been developed for this purpose (Kimmel & Kimmel, 1970). It involves not only extra fluids, but also instructions to hold back urine as long as possible after the urge to void is experienced (Muellner, 1960b), together with shaping to increase the time during which urine is retained (Doleys, Ciminero, Tollison, Williams & Wells, 1977; Doleys & Wells, 1975; Fielding, 1980; Harris & Purohit, 1977; Miller, 1973; Paschalis, Kimmel & Kimmel, 1972; Rocklin & Tilker, 1973; Starfield & Mellits, 1968; Stedman, 1972).

The primary goal of training in these studies was the reduction of bed-wetting and it is difficult to evaluate the effectiveness of retention control training as a means of increasing bladder capacity. Some studies did not provide objective measures of bladder capacity or follow-up data. In addition, some authors have reported results for only one or two children, adequate experimental controls were often absent, and there was considerable variation in the procedures used. However, all the above cited studies suggested that bladder capacity had increased in most of their subjects. Of the studies which provided measures of bladder capacity, two presented group means only so that it is impossible to tell whether all children improved (Harris & Purohit, 1977; Rocklin & Tilker, 1973). Certainly, when retention control training was carried out for only three hours or less a day, bladder capacity increased in only some cases (Doleys et al., 1977; Fielding, 1980; Mahoney, 1973; Starfield & Mellits, 1968). Furthermore, increased bladder capacity also occurred among control children whose only treatment was the recording of base rate frequency or volume (Rocklin & Tilker, 1973). Therefore, although the reasoning behind retention control training has face validity and results were promising in many cases, further research is needed to determine whether the procedure is reliable and effective for a wide range of cases with low bladder capacity.

In order to investigate the effectiveness of retention control training with intellectually handicapped persons, procedural modifications would be necessary. Many such persons could neither understand nor comply with instructions to hold back urine at the first urge to void. The sounding of a pants alarm and the loud "No" at the onset of involuntary voiding provide an alternative to instructions in both the present study and Mahoney's study (1973). However, quite large amounts of urine often escaped before voiding stopped, so that the full bladder required for retention control training no longer existed. To ensure that the bladder was full during the shaping of longer retention times, some form of guidance would be required to stop the flow immediately.

Vincent (1959, 1960, 1964, 1966) described an apparatus which could provide this guidance. It consisted of a saddle piece held firmly in position under the perineum by adjustable straps attached to a waistband. An inflatable rubber balloon, with a rubber syringe and a pressure gauge attached, rested in the saddle so that, in its inflated state, it pressed upwards against the perineum behind the urethral opening. With this apparatus, retention control training would be possible with intellectually handicapped persons. On the sounding of the pants alarm the balloon could be inflated, thus stopping voiding as soon as possible after its onset. The balloon could then be deflated after a few seconds and the subject shaped to continue retention for increasing periods.

8.2.6. Failure to develop bowel control

Child 8, in the non-contingent reinforcement group, was one of the children who completed training to criterion. His baseline records were similar to those of the other children who completed training. His progress through training was smooth and he reached criterion in 17 days. The maintenance programme following training was carried out at school and at home. During maintenance it appeared that, while urinary accidents gradually decreased to only one or two during the last 8 weeks, bowel accidents continued to occur every two or three days. For this reason, maintenance was not completed to criterion in the allotted 180 days. A similar pattern also occurred for child 7 and child 12.

There was no evidence of sphincter impairment, constipation, psychogenic megacolon or overflow soiling in these three children. These conditions have been cited as causes of soiling in non-handicapped children who otherwise perform the toileting sequence reliably (Anthony, 1957; Coekin & Gairdner, 1960; Engel, Nikoomanesh & Schuster, 1974; Kohlenberg, 1973; Woodmansey, 1967). The problem probably involved some learning deficit. However, there has been no indication in the literature on training of the entire toileting sequence that any subjects have successfully acquired all toileting skills, but failed to attach them to bowel tension.

Generally, such training has dealt with all voiding, irrespective of whether it involved the bowel or bladder, and reports have not provided separate data for each function (Azrin, Bugle & O'Brien, 1971; Azrin & Foxx, 1971; Hamilton, 1971; Foxx & Azrin, 1973a; Grabowski & Thompson, 1977; Mahoney, Van Wagenen & Meyerson, 1971; Passman, 1975; Tierney, 1973; Van Wagenen, Meyerson, Kerr & Mahoney, 1969). Only one study is known involving the acquisition of the entire toileting sequence which recorded both bowel movements and urinations (Wright, 1975). This study compared the effects of four complex training procedures and two control conditions using analysis of variance. Although accidents were not completely eliminated in any group within the allotted time of 60 days, significantly greater improvement in both bowel and bladder control occurred in the four training groups as compared with the two control groups. This was reflected in the increasing proportion of toiletings which resulted in voiding, and of toilet voidings which were self-initiated. However, bowel control took longer to acquire than bladder control, although there was no indication that any individual subjects failed to show some improvement in bowel control.

Thus, it was assumed in the present study that incontinent intellectually handicapped persons would acquire both bladder and bowel control when training of the entire toileting sequence was provided. Bowel control was not analysed separately in the design of the chaining programme, and no separate measures of bowel function were planned. Nevertheless, trainers noted bowel movements on the baseline and training records. This has enabled separate representation of bowel movements and urinations for child 8. Figure 8.15 shows the frequency of urinary and bowel accidents during baseline and training and Figure 8.16 shows these as a percentage of all

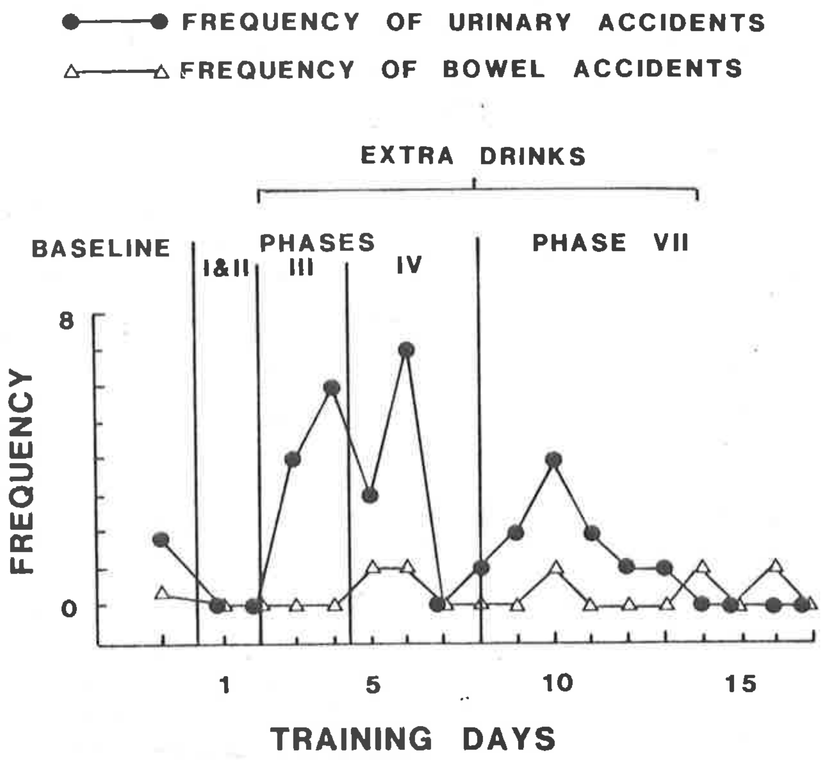


Figure 8.15. Frequency for Child 8 of bladder and bowel accidents.

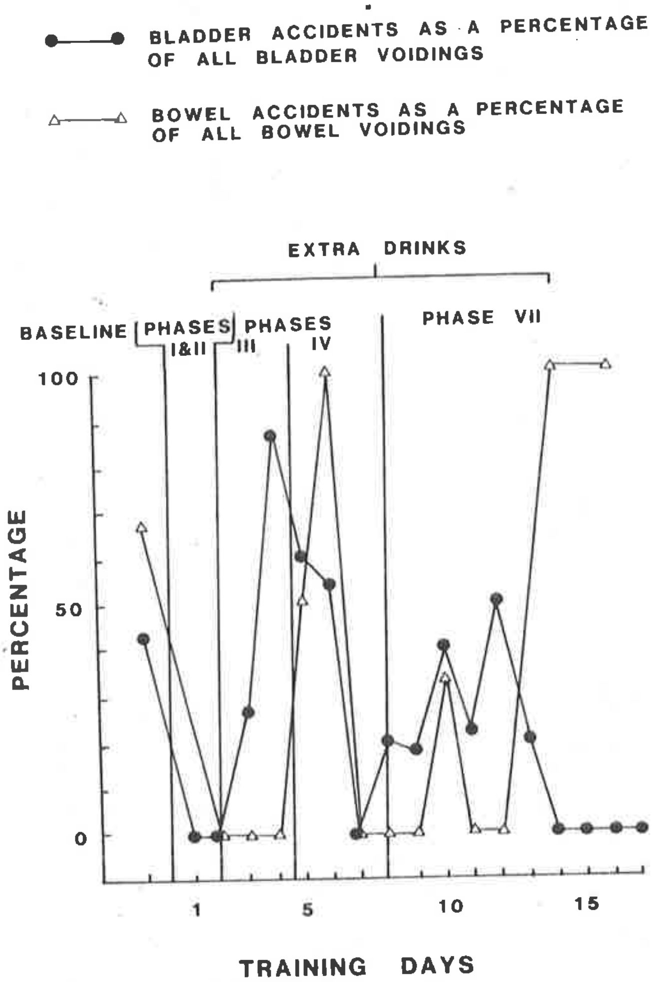


Figure 8.16. The percentage of bowel movements and of urinations which were accidents for Child 8.

bowel and bladder voidings. These figures do not highlight bowel control as a specific problem during baseline and the major part of training. This is partly because urinary accidents were also occurring and bowel movements were infrequent in comparison. However, during the last four days of training, the only accidents which occurred were soilings and there were no bowel actions in the toilet. This shows up particularly in Figure 8.16. Similar evidence of bowel control problems emerged for child 12 at the end of training. Child 6, who also displayed problems of bowel control during maintenance, did not complete training in the allotted time.

Child 8 eventually began toileting himself for bowel actions after the maintenance period. Child 6 did so during maintenance, which was completed to criterion. However, child 12 was still having bowel accidents and an increasing number of urinary accidents 9 months after maintenance. In all three cases the parents and teachers lost confidence in the child's toileting ability. Furthermore, uncontrolled attention during the extensive cleaning up required may have provided stronger reinforcement for accidents than was available for voiding in the toilet. The problem for child 8 appeared to be one of discriminating bowel tension before reflex voiding began. His mother and teachers reported that the majority of soilings during maintenance were discovered when he was found in the toilet area attempting to clean himself. In addition, he was often upset when he soiled. For these various reasons, specific training in bowel control is warranted.

Analysis of responses to those aspects of training aiming to enhance discrimination of bladder and bowel tension, suggests that discrimination of bowel tension was not directly trained. Whereas the pants alarm usually began sounding on the emission of the first few drops of urine, it often sounded only after a large amount of faeces had been voided. Thus, the pants alarm may have become associated with the sensation of voiding rather than with the sensation of bowel tension immediately before voiding. Furthermore, it was obvious to the observer that the stream of urine was interrupted following the sounding of the alarm and the loud "No". Similar interruption of defecation was not apparent. The frequencies of soilings and bowel actions in the toilet, as they appear on the record sheets, cannot be regarded as a reliable record, since their recording was incidental rather than planned. However, where bowel actions were noted, soiling was rarely followed by further defecation in the toilet, whereas further urination in the toilet occurred after most urinary accidents. In addition, the frequency of bowel actions was so low during training (e.g. for child 8 an average of one a day compared with an average of 6 urinations a day) that, even with effective training procedures, strengthening of the skills involved in bowel control was less likely to be completed within the training time.

For these reasons, the procedures designed to strengthen the holding back of voiding in the presence of bladder or bowel tension, as the first response in the toileting sequence, were less likely to be effective in the case of bowel tension. Therefore, other means should be investigated of bringing bowel tension into awareness and ensuring defecation in the toilet so that it can be strengthened.

No controlled research into the acquisition of bowel control has been reported in the literature. However, a number of case studies have described procedures which appear to bring about acquisition. The most commonly described procedure has been immediate reward for defecation in the toilet (Chopra, 1973; Keehn, 1965; McDonagh, 1971; Pedrini & Pedrini, 1971; Peterson & London, 1964; Wolf, 1965; Wolf, Risley, Johnston, Harris & Allen, 1967). Others have punished soiling, usually in conjunction with reward for periods of no soiling (Edelman, 1971; Gelber & Meyer, 1965; Houle, 1974; Logan & Garner, 1971).

The results obtained with these two procedures have varied considerably. One difficulty in training bowel control is knowing when a bowel action is about to take place so that the environment can be arranged to ensure that it occurs in the toilet and that strengthening of toilet voiding can occur. The pants alarm achieves this in relation to urination. A similar effect has been achieved with the insertion of a suppository in the rectum. This usually elicits defecation within a specific time period so that the trainer can be ready to respond. The procedure has been used in conjunction with reward for toilet defecation with a constipated child (Lal & Lindsley, 1968) and children who soiled (Ashkenazi, 1975). Two authors have reported its use with intellectually handicapped children who were not toilet-trained (Barrett, 1969; Giles & Wolf, 1966).

The parents in Barrett's report took their child to the toilet regularly and rewarded every defecation in the toilet. Soiling was not reduced with this method but urinary accidents were. The addition of punishment for soiling accidents, in the form of restraint in a chair, reduced soiling, but did not stop it. With the introduction of suppositories on three successive occasions, in addition to reward for toilet voiding, soiling ceased altogether and the child began indicating when he wished to use the toilet. This suggests that the combination of suppositories which determine when defecation will occur, together with reward for appropriate responding may be more effective than reward alone or reward together with punishment for soiling.

Giles and Wolf (1966) used a range of methods with five severely intellectually handicapped boys to both shape the elements of self-toileting and induce bowel and bladder control. Punishment was used in some cases to reduce soiling. Bowel control was rewarded first. Once self-toileting for defecation had been established, urination in the toilet was also rewarded. Suppositories were used with three of the children to elicit toilet defecation and ensure that reward became associated with it. Although no information is given as to how often suppositories were used or how quickly toilet defecation was established after their introduction, the authors state that all children were consistently toileting themselves without soiling by the end of 90 days of training.

These case studies suggest that by directly rewarding toilet defecation it may be possible to overcome the bowel control problems which three of the children in this study experienced. In addition, the use of suppositories may enhance acquisition, not only by eliciting voiding so that it can be rewarded, but also by intensifying the bowel sensations which are associated with the urge to void, thereby bringing them into awareness as discriminative stimuli for the toileting sequence (Ashkenazi, 1975). However, carefully controlled research is needed to establish which procedures are most effective.

The insertion of suppositories is not difficult, but many trainers and children would find it unpleasant. Therefore it would be wise to use them only after the chaining programme had proved ineffective. Furthermore, reward which follows immediately on toilet voiding may disrupt sequencing if it is provided during training of the entire toileting chain. This was observed to occur in a number of cases during Study 1 (Chapter 6). Consequently, effective bowel training procedures, based on reliable research evidence, should be seen as an available option to be used if soiling continues after self-toileting has been established for urine.

8.2.7. Mastery during baseline

Two children mastered self-toileting during baseline. Child A lived in the institution and child B lived at home. In both cases pants up and down had already been mastered, as indicated in the pre-baseline ratings on the Balthazar day time toileting scale. In addition, sitting on and standing down from the toilet were performed independently from the first baseline day. Despite theses successes, both were having several accidents a day in their normal environments and never toileted themselves. Figures 8.17, 8.18 and 8.19 show the improvements in six measures which were below mastery level either before or at the beginning of baseline for child A. Figure 8.20 shows the improvements in three similar measures for child B.

Children A and B clearly possessed all the skills required for self-toileting and the baseline environment allowed them to be used. It is reasonable to assume that their normal living environments had not allowed these skills to fully emerge. Consequently, institution staff, parents and teachers were asked to carry out the maintenance programme in order to assist them to alter their attitudes and behaviour in relation to the children's toileting.

In both cases, accidents occurred during the early part of maintenance. Child A took five weeks to become accident free at home, while child B had accidents only during the first four maintenance days (Figure 8.21). Accidents for child A are separated into those at home and at school. Discussion with the teachers indicated that they often failed to carry out the maintenance procedures, did not allow children to go to the toilet at unscheduled times and continued to direct child A to the toilet. The record at school shows clearly how this environment maintained accidents (see Figure 8.21). However, in the institution and during a three-day stay with his parents, accident-free self-toileting was maintained. It was subsequently decided to discontinue the maintenance programme at school, since the teachers were unable to co-operate.

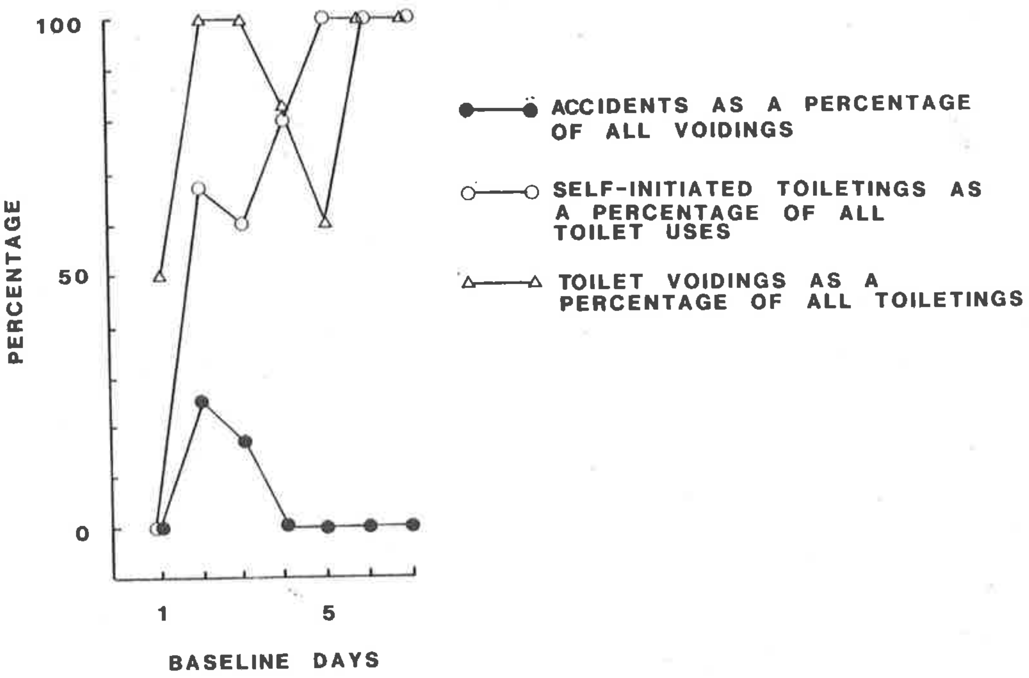


Figure 8.17. Changes for Child A in voiding accidents, toilet use, and self-initiated toileting during baseline.

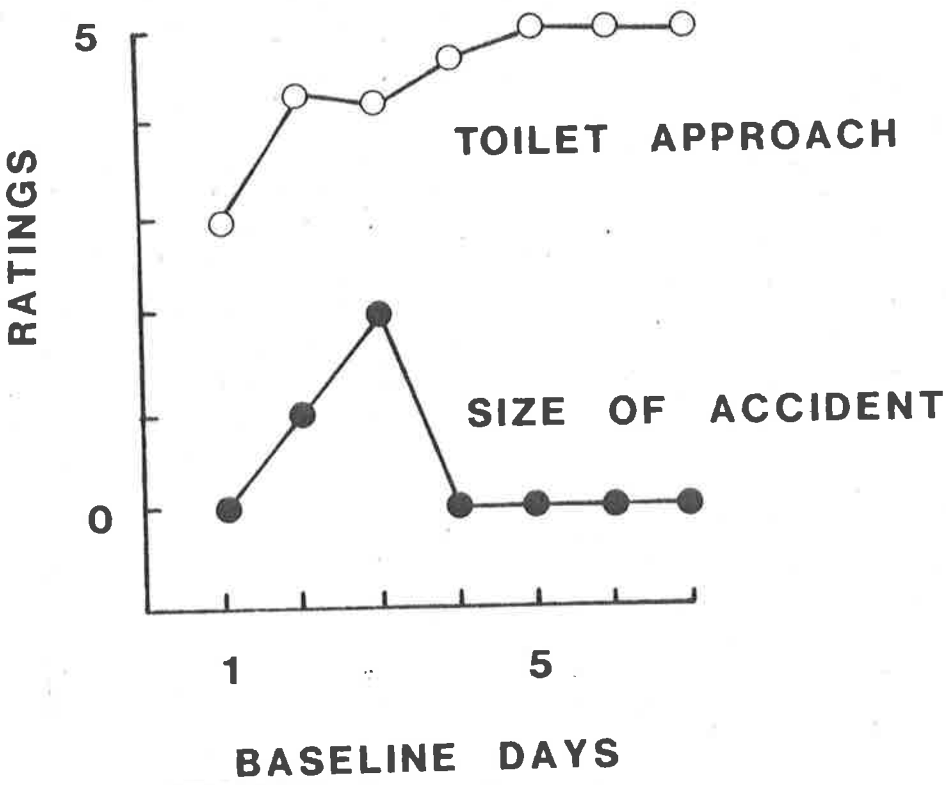


Figure 8.18. Changes for child A in toilet approach and the size of accidents during baseline.

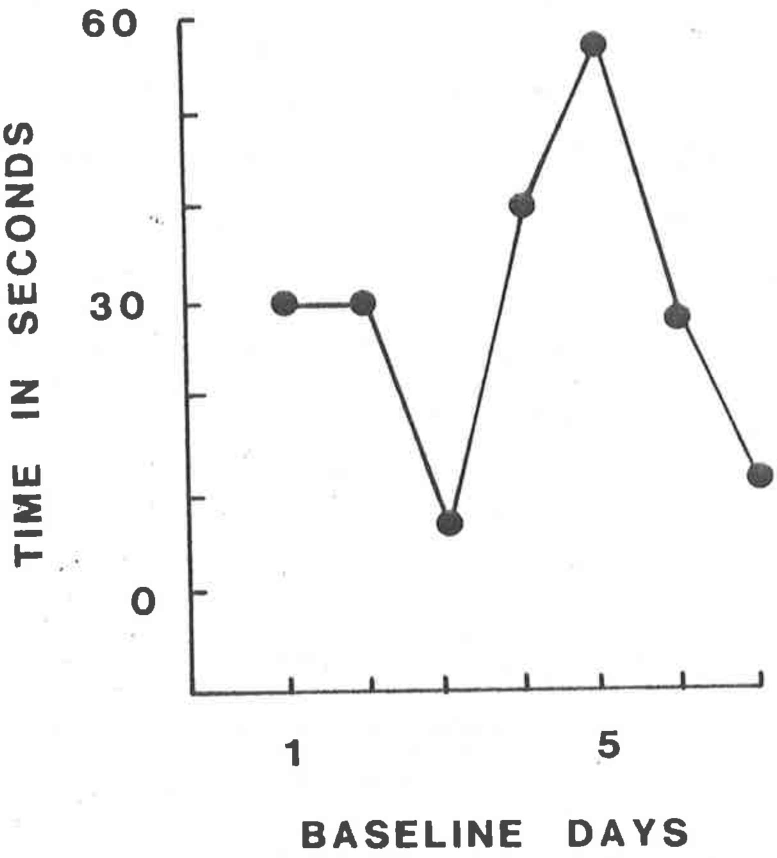


Figure 8.19. Changes for child A in the time taken to initiate voiding on the toilet during baseline.

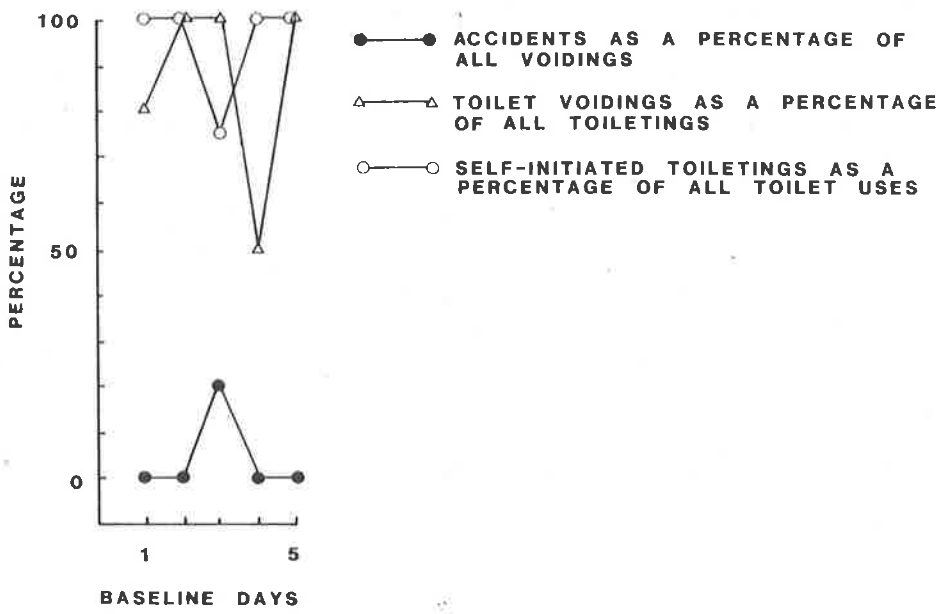


Figure 8.20. Changes for Child B in voiding accidents, toilet use, and self-initiated toileting during baseline.

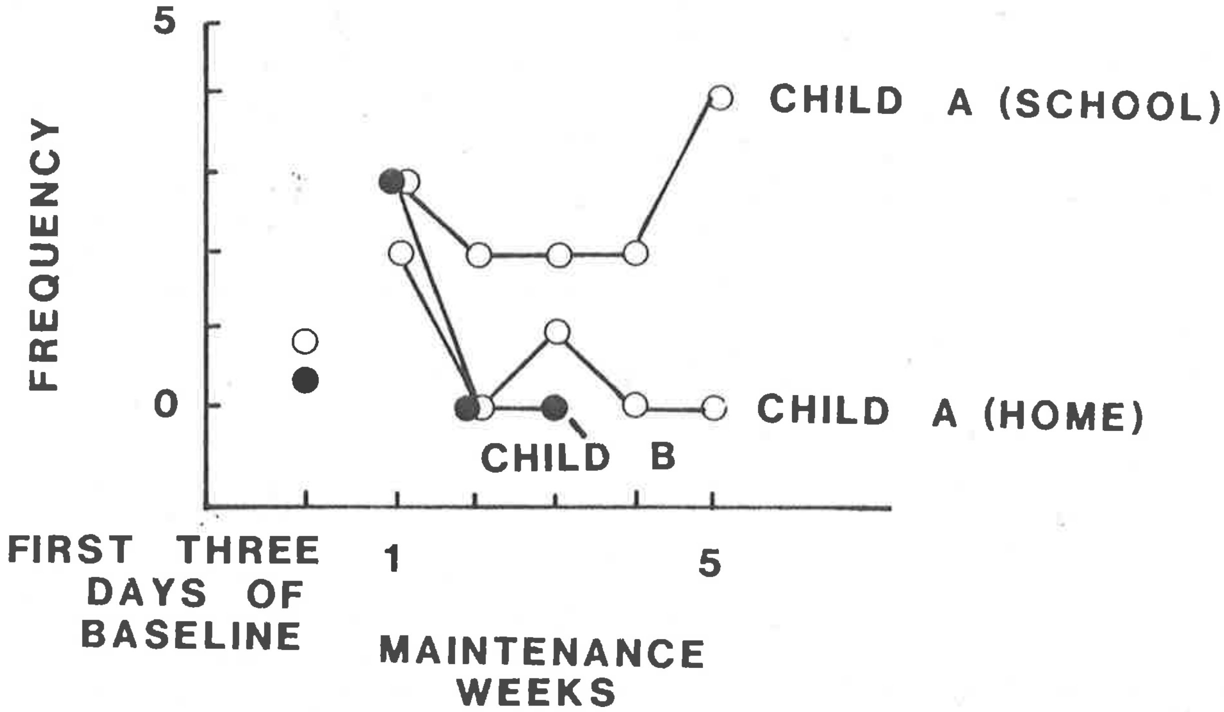


Figure 8.21. Average daily accidents during the first three days of baseline and during the five weeks of maintenance for Child A and Child B.

The experience with these two children raises two important issues in relation to training in general and to this study in particular; firstly, the necessity of an adequate baseline and, secondly, the effectiveness of maintenance.

1. The necessity of an adequate baseline. The function of a baseline in experimental research is to provide a quantitative measure of the "rate and pattern of emitted responses . . . . in an environment in which no special consequences are being provided" (Millenson & Leslie, 1979, p. 29). This constitutes the operant level of the responses. Changes in the rate and pattern of these responses under controlled conditions can then be attributed to the experimental procedures with some confidence. However, if the baseline environment provides special consequences for the responses of interest, then it is not possible to attribute behavioural change to the experimental procedures alone, since the change may also result from cessation of the pre-existing consequences during the experimental period.

In most toilet training, the reported improvement has been measured against a baseline taken in the natural environment. Such a baseline may not reflect the operant level of toileting responses, but instead may reflect the level of performance as it is controlled by the specific set of consequences existing in that environment. Moreover, the natural environment may actually prevent some responses from occurring. In the case of toileting this may occur, for instance, when free access to toilets is prevented or when caregivers frequently take their charges to the toilet or routinely do everything for them. Hence, behaviour change measured against this kind of baseline may represent a return to operant level, with the lifting of imposed constraints and consequences, as well as or rather than acquisition resulting from the training procedures.

The differentiation between operant level and the environmentally maintained level is important for both research and practice. In training research the concern is usually to discover procedures which will lead to the acquisition of new behaviour or the strengthening of partially learned behaviour, rather than merely facilitate the performance of behaviour which is already an established part of the person's repertoire. Furthermore, training procedures which do not lead to real acquisition are of no practical assistance to intellectually handicapped persons whose lack of self-toileting is due to the absence of the required skills.

The baseline observations in this study were made under conditions which, as far as possible, removed environmental constraints and contingencies. The baseline environment in the Unit was the same for all children. Play materials were provided and trainers were involved in informal interactions and play with the children. There were usually three to six children in the unit at a time. Trainers endeavoured to create a secure, happy and stimulating environment and develop positive relationships with the children. Their approach to all activities and tasks was to encourage choice and initiative. They did not interfere with any activity or task unless it was clear that the child could not perform it. In that event, trainers gave the minimum prompt and guidance, increasing this only to the level which enabled completion of the task. Toileting was treated in the same way. On the first baseline day no direction to go to the toilet was given. If every voiding was an accident on that day, the child was thereafter directed to the toilet three times a day with the minimum prompt or guidance in order to provide baseline measures of toileting skills. If self-initiated toileting occurred on subsequent days, prompting to the toilet ceased. In addition, the half-hourly pants checks were carried out as unobtrusively as possible, and accidents were cleaned up and pants changed with as little interaction as possible. No comment, praise, tangible reward or punishment occurred following either toileting or accidents.

These conditions continued until the record showed no improvement over three consecutive days, thus allowing the effects of pre-existing consequences and constraints to extinguish. The baseline records of most children who took part in this study took several days to stabilize: children A and B were the only two whose operant level stabilized at full mastery. The use of this methodology, and the resulting pattern of records, suggests that the baselines used in this study approached a true representation of skill before training, and therefore increases the confidence with which we can accept the measured improvements as representing new learning.

2. The effectiveness of maintenance procedures after training. This study was concerned with factors which affected acquisition during training rather than transfer and maintenance. However, for ethical and practical reasons, it was necessary to provide as much assistance as possible with the transfer and maintenance of self-toileting in the natural environment. Further research is needed to discover which are the most effective maintenance procedures, and directions such research could take are discussed in Chapter 7. However, the performance of children A and B suggests that the procedures used in this study had a considerable effect on the likelihood of continued accident-free self-toileting after training.

Regular discussions with the parents and direct-care staff in these two cases gave no reason to doubt their consistency in recording and carrying out the maintenance procedures. Similarly, the teachers in the case of child B, appeared to be recording consistently, but deliberately neglected to use the maintenance procedures on many occasions because they did not accord with the child management techniques common in the classroom. Figure 8.21 shows that when the maintenance procedures were carried out consistently, accident rate quickly dropped to zero. This occurred at home for both children, whereas accident rate increased for child A at school where maintenance procedures were not used consistently.

Accidents were considered to be a more reliable index of performance during maintenance than self-toileting because they were more easily detected either at the time of occurrence or when the wet or soiled pants were noticed. Self-toileting, on the other hand, increasingly went unnoticed as those recording it relaxed and became more confident of the child's self-control. Even so, it can be assumed that absence of accidents meant that all instances of bladder or bowel tension evoked self-toileting, since no assistance with toileting was given when the maintenance programme was adhered to.

The follow-up assessment on the Balthazar day time toileting scale could be used to consider further performance after the maintenance period. This assessment indicated that child A was having as many accidents and was being directed to the toilet nearly as often at follow-up as before training, while child B was totally self-toileting and accident-free. It has already been shown that toileting was generally maintained better at follow-up by children who lived in their own homes than by children in the institution (Chapter 7). Since child A lived in the institution and child B lived with her family, this difference at follow-up may have reflected the effects of the two different environments rather than the effects of maintenance. Any investigation of the factors affecting the transfer and maintenance of skill should therefore also consider the type of post-training environment.

8.2.8. Discussion

There are several conclusions which this series of case studies suggests. The first three case studies indicate that the number of toileting components possessed before training and the skill with which they are performed determines how long training will take. Generally, those children who performed part or all of each skill at least some of the time during baseline progressed quickly through training. Where skills before training were less developed, training time increased. Those who progressed faster through training did so because they began toileting themselves regularly before all the component skills had been taught. Those who required training in every skill generally had considerably less bladder and bowel control, as evidenced by frequent accidents and many instances of toileting with no voiding, and never toileted themselves during baseline.

The fourth and fifth cases illustrate two specific bowel or bladder control problems which require further research. They suggest that additional performance measures may be necessary to analyse the particular deficits involved, together with additional training procedures which can be used when these problems occur. It should be noted that neither of these problems would have come to light without the continuous recording of the component skills. However, the record of frequency of urination, although it revealed a problem, did not identify its exact nature. The amounts voided over several days should also be recorded and compared with the amounts usually voided by similar children of the same age. If the problem is one of low bladder capacity, this is one measure which should reliably reflect it (Zaleski, Gerrard & Shokeir, 1973). In addition, the detection of bowel problems requires a separate record of urination and defecation.

The last two case studies are of children who achieved mastery during baseline. They emphasize the importance of a rigorous baseline when evaluating the effects of training. If the selection for training had been based solely on the Balthazar day time toileting scale or any other measures taken in the natural environment, both these children would have proceeded through training and their success counted as an indication of programme effectiveness. Failure to continue baseline observations until performance had stabilized may have had a similar result. Not only do these two cases increase the confidence with which improvements in toileting can be accepted as resulting from the training procedures, but they also raise some doubts about many other reports of toilet training success. Those for which data are available have used behaviour in the natural environment as the baseline against which to compare training effects, and the study of the Azrin and Foxx programme reported in Chapter 5 followed their example. Therefore this issue will be considered in the comparison of the two programmes to follow.

The last two case studies also suggest that the maintenance procedures assisted transfer into the natural environment. These case studies also highlight the problems involved in transfer and maintenance. The maintenance procedures used in this study may have led the parents of child B to alter their behaviour towards her toileting permanently, but they did not have the same effect in the institution where child A lived. He reverted to his pre-training accident frequency when these procedures were withdrawn. This was probably due, at least in part, to the frequent changes in staff, many of whom had not experienced the maintenance procedures. In addition, the teaching staff were unaffected by the procedures, since they could not incorporate them into the normal classroom practices. Stokes and Baer (1977) suggest that restructuring the environment to ensure that skills are used after training is an important target of research. Experience during this study suggests that important factors in restructuring may involve organizational change as well as individual behaviour change.

8.3. COMPARISON OF THE AZRIN AND FOXX (STUDY 1) AND THE CHAINING PROGRAMME (STUDY 2)

This section examines evidence which compares the effectiveness of the two toilet training programmes used in the studies reported in Chapters 6 and 7. However, the comparisons made must be treated with caution, since the experimental conditions and measures used were different. These differences came about for both experimental and practical reasons.

The practical constraints were related to the importance of self-toileting in human life. This dictated the applied nature of the research, which was only possible because the institution considered the widespread incontinence among its residents to be a major problem and welcomed any project which might alleviate it. Thus, for the institution, the primary purpose in supporting this research was the design and implementation of effective toilet training procedures for its residents. Consequently, the planning and carrying out of the experimental studies was embedded in a wider set of clinical and administrative processes, which not only were necessary in order for the research to take place, but also prevented a strict comparison of the two toilet training programmes. These processes are described in the Preface.

The major practical development was the setting up of an Intensive Training Unit and the resulting spread of behavioural training skills among staff at the institution. The toilet training research reported here was one of a number of training projects mounted during the early days of the

Intensive Training Unit. At that time staffing, administration and facilities were still being developed. Consequently, the stable environment needed for this research was not available in the Unit and a separate training area with its own staff was provided for Study 1.

By the time that Study 2 was being planned, the Intensive Training Unit was functioning as an integral part of the institution and was seen by the institution as the appropriate setting for training research. Therefore, the physical setting for this study was different. In addition, the Unit's apprenticeship-style staff training function meant that some of the staff available as trainers remained in the unit for approximately two to six months only, and were involved in a number of programmes besides toilet training for Study 2. Therefore, there were many more trainers involved than in Study 1, and trainers were often not available all day or every day. Moreover, parents of community children were involved as trainers for some time each week during Study 2.

These were obvious differences in the conditions of the two studies. Less obvious differences also existed. For instance, the general attitude of staff to Study 1 was sceptical, and few members of the direct care staff were knowledgeable or experienced in behavioural training techniques. The climate was quite different for Study 2. The attitude to training in general and toilet training in particular was positive, and the majority of direct care staff understood behavioural principles and had some experience in their everyday work with at least simple training procedures.

These differences in environmental conditions could not be controlled for and need to be taken into account when attempting to draw any conclusions about the relative efficacy of the two programmes. Further differences in the two studies existed which could be at least partly controlled. For instance, only one of the three experimental factors which were manipulated in Study 1 was considered in Study 2. This factor was the contingency of the consequences delivered during training. Only two groups of four trainees in Study 1, and two groups of six in Study 2 experienced the complete toilet training programme together with either contingent or non-contingent consequences, and these were therefore the only groups which could be used in the comparison of the Azrin and Foxx and the chaining programmes.

Because of the changes in referral patterns during this project there were also subject differences which had to be accounted for in the comparison of the two programmes. For instance, the children who were trained during the two studies were not drawn from exactly the same population. In Study 1, all children lived in the institution. However, that study, together with the work of the Intensive Training Unit and the extensive staff training programmes which it initiated, had helped reduce the number of institution children for whom intensive toilet training was appropriate. Furthermore, the Unit's success had led to a widening of its clientele to include children from outside the institution. Therefore both institution and home children were involved in Study 2.

In each study, groups were approximately matched on three variables which had shown some relationship with the likelihood of becoming toilet trained (see Chapters 5 and 7). These were age, general intelligence as indicated by the Social Quotient on the Vineland Social Maturity Scale (Doll, 1936), and pre-training toileting skill as indicated by scores on the Balthazar day time toileting scale (Balthazar, 1971). However, the referral groups from which trainees were drawn were too small to allow either complete matching on these variables within each study, or approximate matching across the two studies.

The mean values of these variables for the compared groups from the two studies are shown in Table 8.2. Differences between the means within each study had been minimized by approximate matching. Differences between the two programmes were evident and were examined using the t test. There were no significant differences in age or Balthazar toileting score, but the Social Quotient was significantly (and considerably) higher in the chaining programme (Table 8.2). Some control on the possible influence of these variables was made during the comparison of the two programmes by including them as co-variates.

TABLE 8.2. Mean age, Social Quotient on the Vineland Social Maturity Scale and scores on the Balthazar day time toileting scale before training for the contingency and non-contingency groups in the two toilet training programmes.

PROGRAMME	GROUP	MEAN AGE	MEAN SQ	MEAN BALTHAZAR SCORE
Azrin & Foxx programme	Contingent consequences (n=4)	12.68	14.63	21.50
	Non-contingent consequences (n=4)	13.28	13.55	19.00
	Both groups	12.97	14.09	20.25
Chaining programme	Contingent consequences (n=6)	10.07	29.58	27.50
	Non-contingent consequences (n=6)	10.26	26.05	25.00
	Both groups	10.17	27.82	26.25

Note: The t-test was used to test the difference of total means between programmes. The results were as follows:

Mean age: $t=1.30$, $df=18$, N.S.
Mean SQ: $t=2.59$, $df=18$, $p<.05$
Mean Balthazar Score: $t=1.12$, $df=18$, N.S.

The effects of the two toilet training programmes on all aspects of the toileting sequence could not be assessed. This was because the importance of monitoring each component skill only emerged gradually during this research programme. The frequency of accidents has generally been the major, if not the only measure reported in the toilet training literature and accident rate was therefore the measure chosen for the pilot study. However, observation during that study suggested that the frequency of accidents may not always reflect self-toileting skill. As a result it was decided to use a standardized measure of toileting in Study 1, based on ratings of a number of toileting components rather than only one component such as accident rate. The Balthazar toileting scale was selected for this purpose. At the same time several discrete toileting behaviours were recorded, either throughout training or at the end of training, in order to assess their ability to reflect changes in self-toileting skills.

Although ratings on the Balthazar toileting scale after training showed general improvement for all groups irrespective of the experimental variations in training procedures, some of the discrete measures did react differently to variations in the training procedures. In addition, a more detailed examination of the training records indicated that there were marked individual variations in performance of some of the component skills, some of which were not mastered even by children who achieved the training criterion. For instance, accident rate for some children increased rather than decreased, self-toileting often occurred without any accompanying voiding in the toilet, and a number of children did not master toilet flushing which was the final response in the toileting sequence as taught by the Azrin and Foxx procedures. These variations were not revealed either by the Balthazar ratings or by the fact of attaining the training criterion.

Study 1 led to the conclusion that reliable toilet training required separate procedures to teach each component of the sequence as well as to strengthen the sequence as a whole, and that their effectiveness could only be assessed by quantifying each of the component skills. Consequently, a new set of training procedures, designed for this purpose, was used in Study 2, together with a set of ten measures to assess the performance of each component, as well as overall toileting. Three of the measures used in Study 2 were also recorded during Study 1 and these formed the basis for the comparison of the two programmes, although that comparison was necessarily incomplete. Improvement on the Balthazar toileting scale some time after training had been completed was also examined.

The three measures consisted of improvement in the percentage of voidings which were accidents, the percentage of toiletings which resulted in toilet voiding, and the percentage of toilet voidings which were self-initiated. Since these measures were not initially planned as dependent variables in Study 1, no baseline was taken. Therefore, in order to assess differences in improvement resulting from the two programmes, changes in performance during training were calculated by taking the difference between the average daily scores during the first and the last three days of training. Use of the first three days of training as a control period is not ideal, since training procedures during the early part of training were markedly different in the two programmes; the first three training days do not, then, provide a "standard baseline". This was especially so since the group means on the "percent accidents" measure in the two programmes (Table 8.3) differed significantly, as shown by analysis of variance ($F = 10.75$, $df = 1, 17$, $p < .01$). As an additional precaution, therefore, the contribution of the "start of training" measure to any differences in improvement was examined by including the relevant measure as a co-variate in each comparison.

TABLE 8.3. Mean scores during the first three days of training on three measures of toileting performance for groups receiving contingent and non-contingent consequences in the two toilet training programmes.

PROGRAMME	GROUP	PERCENT ACCIDENTS /TOTAL VOIDINGS	PERCENT TOILET VOIDINGS/TOTAL TOILETINGS	PERCENT SELF-INITIATED TOILETINGS /TOTAL TOILET USES
Azrin & Foxx programme	Contingent consequences (n=4)	19.50	95.50	25.25
	Non-contingent consequences (n=4)	24.50	86.50	16.50
	Both groups	22.00	91.00	20.88
Chaining programme	Contingent consequences (n=6)	59.17	76.17	7.83
	Non-contingent consequences (n=6)	58.67	74.50	16.17
	Both groups	58.92	75.33	12.00

8.3.1. Results

With these constraints in mind, there is nevertheless some indication that the chaining programme used in Study 2 was more successful than the Azrin and Foxx programme followed in Study 1. The mean improvement scores in each study on the three measures are shown in Table 8.4. The two groups available for comparison in each programme received either contingent or non-contingent consequences. Two-way analysis of variance was used to test for contingency and programme effects. The analysis was initially carried out with age, Social Quotient and Balthazar day time

TABLE 8.4. Mean improvement scores at the end of training on three measures of toileting performance for groups receiving contingent and non-contingent consequences in the two toilet training programmes.

PROGRAMME	GROUP	PERCENT ACCIDENTS /TOTAL VOIDINGS[a]	PERCENT TOILET VOIDINGS/TOTAL TOILETINGS[a]	PERCENT SELF-INITIATED TOILETINGS/TOTAL TOILET USES[a]
Azrin & Foxx programme	Contingent consequences (n=4)	- 4.25	- 4.00	44.25
	Non-contingent consequences (n=4)	3.25	- 3.25	11.75
	Both groups	- 0.50	- 3.63	28.00
Chaining programme	Contingent consequences (n=6)	36.00	20.78	61.33
	Non-contingent consequences (n=6)	43.83	22.60	64.00
	Both groups	39.92	21.69	62.67

[a] Differences were calculated in the direction such that all positive values indicate improvement.

Note: Because the groups trained with the two programmes were not matched, the improvement scores cannot be interpreted without allowing for the beginning of training scores (see Tables 8.5, and 8.6).

toileting score as co-variates, to control for any influence which these variables may have had on improvement during training, as described earlier. In the event, the influence of these variables was not significant, and the analysis of variance results are therefore reported without these co-variates.

When the beginning of training performance for each measure was included as a co-variate, two significant relationships were found. On the measure of accidents as a percentage of all voidings, performance at the beginning of training had a significant influence on the amount of improvement during training (standardized Beta = .96). Those with a higher accident rate at the beginning of training showed the greatest reduction of accidents. On the measure of toilet voidings as a percentage of all toiletings, performance at the beginning of training was also significantly related to the amount of improvement during training (standardized Beta = - .88). Those who voided least often when they went to the toilet at the beginning of training showed the greatest improvement. The analysis of variance results for these two measures are therefore shown with these co-variates (see Appendices 8.1 and 8.2). No significant relationship was found between beginning of training performance and the amount of improvement on the third measure, percentage of toiletings which were self-initiated (standardized Beta = - .19). Even so, the relationship was in the same direction; that is, those who rarely self-initiated at the beginning of training improved most on this measure. The analysis of variance results for this measure are shown without the co-variate (see Appendix 8.3).

There were no significant programme effects for the accident measure (Appendix 8.1). Most of the variance in improvement was contributed by differences during the first three training days. The difference in group means when adjustments were made for the co-variate can be seen in Table 8.5. However, there were significant programme effects on improvement for the other two measures. The percentage of toiletings which resulted in toilet voiding improved significantly more during the chaining programme even though the beginning of training scores contributed significantly to the overall variance (Appendix 8.2). This could be seen quite clearly when the means were adjusted for the co-variate (Table 8.6). The percentage of toilet voidings which were self-initiated also increased more during the chaining programme with no significant effect of the start of training scores (Appendix 8.3). There were no significant effects of contingency on any of the three measures.

TABLE 8.5. Effects with and without covariate adjustment: variable is percent accidents/total voidings.

(a) Main effects for improvement without adjusting for the covariate "percent accidents/total voidings at the beginning of training".		
	Mean for Azrin and Foxx programme	Mean for chaining programme
(i) Programme effect	- 0.50	39.92
	Mean for contingent condition	Mean for non-contingent condition
(ii) Contingency effect	19.90	27.60
(b) Main effects for improvement scores after adjusting for the covariate "percent accidents/total voidings at the beginning of training".		
	Mean for Azrin and Foxx programme	Mean for chaining programme
(i) Programme effect[a]	18.67	27.13
	Mean for contingent condition	Mean for non-contingent condition
(ii) Contingency effect[a]	20.64	26.86

[a] These main effects were not significant for this variable.

TABLE 8.6. Effects with and without covariate adjustment: variable is percent toilet voidings/total toiletings.

(a) Main effects for improvement scores without adjusting for the covariate "percent toilet voidings/total toiletings at the beginning of training".		
	Mean for Azrin and Foxx programme	Mean for chaining programme
(i) Programme effect	- 3.63	21.69
	Mean for contingent condition	Mean for non-contingent condition
(ii) Contingency effect	16.78	19.35
(b) Main effects for improvement scores after adjusting for the covariate "percent toilet voidings/total toiletings at the beginning of training".		
	Mean for Azrin and Foxx programme	Mean for chaining programme
(i) Programme effect*	4.12	16.54
	Mean for contingent condition	Mean fo non-contingent condition
(ii) Contingency effect	12.77	10.37

* This main effect was significant (see Appendix 8.2).

Thus, the two programmes did not appear to differ in how well they taught the skill of holding back involuntary voiding in the presence of bladder or bowel tension. However, acquisition of the ability to start voiding when on the toilet was better with the chaining programme. This finding was supported by observations during the whole training programme. There were far fewer instances of toileting without voiding during the chaining programme, and these occurred only during the early part of training. During the Azrin and Foxx programme there were many such instances throughout training. Children were also better at performing the entire sequence by the end of training with the chaining programme. Not only was the mean improvement greater by the end of this programme, but all children were toileting themselves most of the time, whereas half the children rarely or never toileted themselves by the end of the Azrin and Foxx programme.

Furthermore, there were no instances of children confusing the order of responses in the toileting sequence at any time during training with the chaining procedures, whereas several who were trained with the Azrin and Foxx procedures had difficulty with sequencing and still occasionally misplaced responses in the sequence after they had begun to toilet themselves regularly. In addition, only one child in the chaining programme failed to maintain reliable self-toileting during training once she had begun the self-toileting phase. As a result, she was returned to an earlier phase until self-toileting returned to its former high rate. In contrast, all but two of the eight children in the Azrin and Foxx programme returned to the bladder training phase several times because self-toileting was established but not maintained.

Improvement at follow-up was also tested. Follow-up assessments on the Balthazar day time toileting scale were made 7 to 14 months after training, and these were compared with the pre-training assessments in both studies. Mean improvement for the four comparison groups are shown in Table 8.7. There was no significant relationship between performance before training and improvement at follow-up. The mean improvement was slightly greater for the chaining programme, but there were no significant programme or contingency effects revealed by analysis of variance. Thus, although the entire self-toileting sequence was more readily acquired with the chaining programme than with the Azrin and Foxx programme, this difference was not statistically significant after the children had spent some months in the non-training environment.

TABLE 8.7. Mean improvement scores at follow-up on the Balthazar day time toileting scale for groups receiving contingent and non-contingent consequences in the two toilet training programmes.

PROGRAMME	MEAN IMPROVEMENT [a]		
	CONTINGENT GROUP	NON-CONTINGENT GROUP	BOTH GROUPS
Azrin & Foxx programme (n=4)	0.25	9.25	4.75
Chaining programme (n=6)	18.80	8.33	13.57

[a] Differences were calculated in the direction such that all positive values indicate improvement.

8.4. DISCUSSION

Conclusions about the relative merits of the two toilet training programmes on the basis of these results can only be tentative. The most telling evidence for the greater effectiveness of the chaining programme lies in the greater improvement in self-toileting which it produced. This was the primary target of training in both programmes.

A self-initiation was recorded when the urge to void was recognized and the child carried out the entire toileting sequence successfully and in the correct order without any assistance. Toileting was not recorded as a self-initiation when the urge to void was not recognised in time and an accident occurred, when the child did not void in the toilet, or when some help was needed with some part of the sequence. The daily frequency of self-initiations was then converted to a percentage of daily toilet voidings to provide a picture of selt-toileting which was not contaminated by how skilled the children were at preventing involuntary voiding.

It was important to separate this latter response from the self-toileting measure because it appears to involve a set of skills which not only differ in nature from those involved in the rest of the sequence, but are also more difficult to learn. Numbers of non-intellectually handicapped children toilet themselves competently but still have bladder or bowel accidents during the day (Bellman, 1966; Blomfield & Douglas, 1956; Hallgren, 1956; Lapouse & Monk, 1964). In addition, two reports of toilet training with intellectually handicapped children found that, while toileting improved, there was little or no reduction in accidents (Hundziak, Maurer & Watson, 1971; Watson, 1968). Although the training procedures in these cases were not directed at establishing the entire toileting chain, a similar result occurred in Study 1 when training was directed at the entire chain. There was no evidence that the accident procedures in the chaining programme would be any more effective than those in the Azrin and Foxx programme. It was therefore decided to assess performance of the rest of the chain separately, in order to discover how well the responses were sequenced, irrespective of possible difficulties in preventing involuntary voiding.

It does appear that the chaining programme taught the defined self-toileting skills more effectively than the Azrin and Foxx programme. Its greater success may have resulted from both the attention paid to building the responses into the sequence one at a time and the overlearning which occurred during each training phase. Certainly there was no sign of the misordering of responses which was observed during the Azrin and Foxx programme. Furthermore, all but one child in the chaining programme were toileting themselves most of the time by the end of practice, in contrast to only four of the eight children in the Azrin and Foxx programme.

The ability to initiate voiding once on the toilet also improved more during the chaining programme. However, some of the apparent differences between programmes may have been due to procedural artifacts. Children in the Azrin and Foxx programme voided more often at the beginning of training when they were toileted. This was because voiding frequency in general was increased by the extra drinks and the half-hourly toileting trials, thus ensuring that many voidings were caught in the toilet. In contrast, no extra drinks were given and toileting occurred only a few times a day during the first two phases of the chaining programme, thus making it less likely that toileting and a full bladder or bowel would coincide.

Nevertheless, there was room for improvement on this measure in all four comparison groups. However, even when the variance contributed by the beginning of training measure on this variable was controlled, the mean percentage of toiletings which resulted in voiding had actually decreased by the end of the Azrin and Foxx programme. Some of this deterioration occurred in children who were still being assisted with toileting, but inspection of individual records indicated that voiding was also absent during many self-initiations. In fact, the only children who voided during all toiletings at the end of training were those who also did so at the beginning of training. During the chaining programme, there were few instances of toileting without voiding after the first few days of training. All children voided during every toileting by the end of training, except on the rare occasion when a full accident occurred, after which they were unable to produce any more in the toilet.

These results can be explained by the different arrangement of toileting trials in the two programmes. During the Azrin and Foxx programme, toileting trails occurred whether or not the bladder or bowel had reached full capacity, whereas the chaining procedures ensured that they only occurred when full capacity was reached. This mazimized the likelihood that voiding could occur during toileting so that not only were the required muscle skills practised on almost every trial, but bladder or bowel tension became established as the necessary signal for toileting to be performed.

While the muscle control required to voluntarily turn on voiding approached complete mastery when the chaining programme was used, the muscle control to prevent accidents was not mastered with either programme. Inspection of the group means in Table 8.4 suggests that there was a greater reduction in accidents during the chaining programme. However, differences in improvement between the two programmes on this accident measure were not significant when performance at the beginning of training was included as a co-variate in the analysis.

Devising effective training procedures for this skill poses particular difficulties because neither the discriminative stimuli of bladder and bowel tension nor the muscle action required to hold back voiding can be observed or directly manipulated. Neither is there any product to indicate when success is achieved as there is in voiding. Observation during training suggests two solutions which may improve acquisition of this skill, as follows.

Although no baseline measure of accidents was available in Study 1, a baseline was taken in Study 2. The percentage of voidings which were accidents at the end of training was compared with the baseline percentage. This comparison showed that accidents were reduced for all but one child, and this improvement was significant for all groups. It is therefore possible that longer training would enable this skill to be mastered. The inhibition of accidents was the one component of toileting which was not added at the correct place in the sequence and was not taught separately until it reached a predetermined criterion. Training which continues until several accident-free days occur after self-toileting has been well established might enable trainees to concentrate on and master the skills required.

It may also be possible to provide more direct training procedures. The major difficulty in the training of this skill arises because there is no way of telling when perineal tensing should occur in order to prevent involuntary voiding. The pants alarm sounded after involuntary voiding had begun so that there was no opportunity to apply procedures to induce and strengthen the response of perineal tensing before the onset of voiding. However, it may be possible to detect impending voiding before it occurs. The levator ani muscles in the perineal region are in a constant state of tonus, and the action currents only fall to zero just prior to and during the act of urination or defecation (Vincent, 1964; Yeates, 1973). The changes in action potential can be monitored using an electromyograph. Continuous recording on such an instrument may allow detection of impending voiding before it begins instead of after its onset, so that the procedures directed at training perineal tensing could be applied at the appropriate time. With a procedure of this kind, learning may take less time and be more certain. However, the recording instrument would need to be portable so that free movement during toileting was not impeded.

There was general improvement in toileting ability at follow-up, as measured by the Balthazar day time toileting scale, with no significant difference between the two programmes. These improvement scores cannot be taken as a firm indication of the relative effects of the two programmes on performance after training, because other factors intervened between the end of training and the follow-up assessment. Not only were the maintenance procedures after training different in the two studies, but the influence of constraints and contingencies in the natural environment could not be controlled. These factors probably outweighed any differences in performance after training which may have resulted from the different training procedures. It is possible that, once toileting skills have been established, the factors which maintain performance have little to do with the initial training procedures, unless additional procedures are built into training to specifically enhance maintenance (Baer & Stokes, 1977; Stokes & Baer, 1977). Neither the Azrin and Foxx nor the chaining programme contained such enhancing procedures, although a maintenance programme was provided after training.

Uncontrolled factors may also have effected improvement during training. One such factor was suggested by the case studies of the two children who became self-toileting during baseline. An adequate baseline was not taken in Study 1, since it was assumed on the basis of other studies that children who were not self-toileting in their natural environments did not possess all the required skills. It is therefore possible that the performance of at least some children in Study 1 resulted from withdrawal of the natural contingencies rather than from the training procedures.

Although this comparison only allows tentative conclusions about the relative efficacy of the two programmes, it does pinpoint many of the factors which need to be controlled when training procedures are being compared either with each other or with control conditions. A more precise comparison of the two programmes reported here would require a separate study in which the two programmes were run in a standard training environment with measures of all toileting responses recorded throughout a controlled baseline and training.

CHAPTER 9.

GENERAL DISCUSSION

This chapter summarizes and discusses the findings from the investigations reported in Chapters 2, 5, 6, 7 and 8, concerning incontinence and toileting in retarded persons. Issues arising from the results of these studies are related to the acquisition of complex human skills in general, and to the design of training programmes to teach skilled performance.

The details of treatment methods used to bring about continence in persons who have not developed adequate bladder and bowel control derive from theories concerning the causes of incontinence. Operant learning theory has had a considerable influence on the treatment methods used with both non-handicapped children and retarded persons over the past two decades. According to this approach, most children and retarded persons who fail to become continent do so because of faulty learning, and the most appropriate treatment is therefore to teach toileting skills.

The survey of retarded residents at Strathmont Centre partially supported this view. More than half of the 611 persons surveyed were found to be incontinent to some extent. The prevalence of incontinence decreased with age and increased with level of retardation. These findings are in keeping with the results of similar surveys of retarded persons in other countries, and support the notion that learning is involved in the development of continence.

On the other hand, the survey also suggested that faulty learning does not provide a sufficient explanation for incontinence. Thus, medical assessments of residents under 21 years of age indicated that more than half of those who were incontinent also suffered from organic conditions considered likely to interfere with the achievement of continence and the prevalence of incontinence in this group did not decrease with age. Moreover, incontinence associated with organic conditions was found to be concentrated among the severely and profoundly retarded residents.

Such findings highlight the need for assessment methods which can identify organic pathology as well as skill deficits, and the development of treatment methods directed at overcoming both. Future research into improving the effectiveness of treatment for incontinence among a wide range of retarded persons needs to take these findings into account.

When incontinence exists with no evidence of organic involvement, learning or maturation explanations appear to be the most reasonable, especially in view of the increase in continence with age. The development of toilet training procedures would seem to be the most promising approach to the treatment of incontinence of this kind, and this was the focus of the research reported in this thesis.

The learning explanation is partially supported by evidence that incontinence can be reduced by toilet training. Evidence of this kind has been reported for both non-handicapped children and retarded persons, and was reviewed in Chapter 3. The three toilet training studies reported here add further support in relation to retarded persons. However, this support was qualified by the minimal improvement observed in some trainees, especially during the pilot study. The failure of these subjects to improve may be attributed either to a cause unrelated to a learning problem or, alternatively, to inadequate training procedures.

An analysis of individual performance in the pilot study, both during training and some time after training had ceased, indicated that inadequate procedures were probably at least partly involved. These procedures were derived from Azrin and Foxx (Azrin & Foxx, 1971; Foxx & Azrin, 1973b), but the study did not permit a clear analysis of which variables were responsible for success and which were irrelevant or possibly even interfering with progess. The two experimental studies, referred to as Studies 1 and 2 and described in Chapters 6, 7 and 8, therefore examined the effects of a number of variables on improvement in toileting during and after training. These variables were of two types, being either subject characteristics previously shown to be related to improvement in toileting or training strategies commonly used in toilet training programmes.

The subject characteristics considered were initial toileting ability before training, age, general intelligênce, as measured by the Vineland Social Maturity Scale (Doll, 1936) and length of residence in an institution. The last three of these variables were found to be unrelated to improvement when intensive toilet training was provided, and the importance of initial toileting ability, suggested by the results from Study 1, was not confirmed when the training procedures were modified in Study 2. This finding suggests that these variables only predict improvement in toileting skills under conditions of standard institutional care.

It was suggested in Chapter 6 that the restricted age range of subjects and the restricted training time in Study 1 may have prevented the relationship of improvement with age and general intelligence from appearing (Smith & Smith, 1977). However, in view of the failure to find a relationship with initial toileting ability in Study 2, when improved training procedures were used, it is possible that many individual differences among subjects became less important as the effectiveness of training procedures is increased (Bloom, 1976).

The training strategies examined in Study 1 consisted of contingent reward and punishment for appropriate and inappropriate voiding, guidance for the self-management tasks that were not involved directly in bladder or bowel control, and contingent alarms as aids in response detection and reinforcer delivery. The majority of trainees improved in at least some aspects of toileting, irrespective of the training strategies used. Moreover, the three experimental strategies together appeared to result in shorter training times, although this finding must be treated with caution because of the small number of subjects in this condition.

Each of the three training strategies conferred some advantage during training when compared with control conditions. Guidance appeared to enhance performance of the self-management tasks at the end of training, although this effect must also be treated with caution because no assessment was made of the performance of these tasks at the beginning of training. Guidance, together with contingent alarms, also enhanced the speed with which the first four toileting tasks (toilet approach, pulling pants down, sitting on the toilet, and bringing about voiding) were performed. Speed of performance on the first four tasks was also improved when consequences were made contingent on voiding. Thus, the results from Study 1 indicated that contingency had a significant influence on performance speed, but did not appear to be important in reducing accidents, increasing toilet voidings, or bringing about self-initiated toileting.

Three questions were raised by these findings.

1. Would contingency have clearer effects when it was considered in relation to positive reinforcement alone, while all other aspects of training remained unchanged.
2. Would contingency effects be displayed more clearly when the structure of the training programme was more firmly based on the operant principles of chaining and stimulus control, and provided opportunities for overlearning?

3. Alternatively, does reinforcement, whether contingent or non-contingent, have little part to play during the acquisition of toileting skills when an intensive, structured programme of training is provided?

Study 2 examined these questions, finding that neither contingent nor non-contingent reinforcement increased the effectiveness of training.

Before discussing possible explanations for the ineffectiveness of "reinforcement" conditions, the issue of reinforcer selection needs to be clarified. In both Study 1 and Study 2 the rewards used during toilet training were selected on the basis of both their effectiveness in previous research and their "demonstrated" effectiveness for the subjects in question in strengthening simple motor responses. In some cases this method established only one effective reinforcer, and in others several stimuli were found to be reinforcing. Rewards included various foods and objects such as pieces of string or paper, toys, a music box or being picked up and whizzed around. During toilet training, one of the reinforcers selected for the particular child was delivered in the reinforcement conditions, along with praise and physical affection.

Reinforcers such as these have previously been shown to be effective in strengthening a range of behaviour in retarded persons (Siegel, 1968; Spradlin & Girardeau, 1966). In addition, a number of authors have compared reinforcement with no reinforcement and have found that both food and toys strengthened toileting behaviour (Ando, 1977; Brown & Brown, 1974; Hundziak, Maurer & Watson, 1971; Passman, 1975; Tomlinson, 1970).

The failure to find clear reinforcement or contingency effects in Study 1 and Study 2 may be interpreted in several ways. It has been argued that the success of reinforcement in many training programmes for retarded persons was due to the increased attention which trainees receive rather than to delivery of the reinforcement itself (J.M. Gardner, 1969; Gunzberg, 1974). Blackwood (1963) certainly believed that increased attention to trainees was a major factor in the improved toileting of both reinforced and non-reinforced subjects in his study. However, it is not clear how increased attention might function as a facilitator for the learning of specific responses by retarded persons. It is possible that trainers in a naturalistic setting acquire discriminative stimulus properties because they meet many of the needs of their trainees (Spradlin, Fixsen & Girardeau, 1969); that is, their presence or close attention to the trainee comes to signal that reinforcement is likely to follow. Furthermore, the mere presence of the trainer may become reinforcing, because it has been associated frequently with the natural delivery of reinforcements such as food, drink and physical affection.

In training programmes such as those used in the studies reported here, the exact response which is required is made very clear through the use of prompts and guidance, thus providing information which programmed contingent reinforcement would otherwise offer (Estes, 1971). In these circumstances, the discriminative stimulus and reinforcing properties of the trainer might operate quite powerfully to both cue and motivate the trainee so that extrinsic reinforcement may add very little to the reinforcement already provided by the trainer's presence. Such a development would account for the success of trainees in the so-called no reinforcement condition in Study 2.

It would be difficult to test this hypothesis in relation to toilet training, although some evidence supporting it exists in relation to responses less complex than those involved here. For example, Redd (1969) demonstrated that an adult's presence had a facilitatory effect on the play behaviour of retarded children. The adult in that study sometimes rewarded the children contingently and sometimes non-contingently, so that this situation was somewhat analogous to the interactions between trainer and trainee during non-training periods in Study 1 and 2. Non-contingent reward produced no change in behaviour in Redd's study until the adult withheld reward, but at that point the children began playing in the manner required for reinforcement.

The above interpretation raises the possibility that reinforcement and its contingency had some effect on acquisition during Study 2, but that the programmed extrinsic reinforcement was of little benefit. This interpretation has practical implications for the training of complex skills. The emphasis commonly placed on extrinsic contingent reward may be unnecessary, at least for the trainee. However, it may be important that the trainer have close and rewarding contact with the trainee for some time before attempting training.

Reinforcement was only one of a number of principles employed in the two toilet training programmes. In fact, it was suggested in Chapter 7 that principles other than reinforcement were the essential factors controlling acquisition during the chaining programme. Those factors included the principles used to induce correct responses, the presentation of tasks to be learned in an orderly sequence of steps, and overlearning through the repeated practice of responses after they had been acquired.

One view of the way in which reinforcement operates in the learning situation emphasizes its incentive function. For example, Siegel (1968) has argued that the presentation of reward following emission of the required response induces the subject to try that response again in a similar situation. According to this view, anticipation of the reward acts to facilitate overt emission of the response rather than to facilitate learning. What is learned is a particular set of S-R or S-S associations through repetition (Estes, 1969).

In the chaining programme used in Study 2, prompts and guidance ensured that the correct self-management responses were emitted when they were required, while toilet voiding was generally ensured by running toileting trials only when the bladder or bowel was full. These procedures would therefore have acted to induce responses, thus making this function of reinforcement redundant.

Reinforcement has also been seen by a number of theorists as having a feedback function (Atkinson & Wickens, 1971; Bloomfield, 1972; Estes, 1971). According to this view, when reinforcement is contingent on one response and not on others, its occurrence informs the subject that the response emitted was correct and its non-occurrence that the response was incorrect. This function of reinforcement may also have been redundant in the chaining programme, since feedback in the form of guidance was provided for the self-management tasks, and the alarms filled a similar role in relation to the bladder and bowel control skills. Moreover, information about the correct ordering of tasks was provided by the step-by-step chaining process.

The above discussion suggests that a number of factors are responsible for success in toilet-training. Smith (1979) was of the opinion that the major factor is the provision of a structured framework rather than the particular strategies used within that framework. The research reported here suggests that, although contingent extrinsic reinforcement may not be an essential component of successful programmes, other strategies may be important. This was indicated by the greater success of the chaining programme when compared with the Azrin and Foxx programme.

The comparison of the two programmes was made in terms of improvement on three response measures, namely, the percentage of voidings which were accidents, the percentage of toiletings which resulted in voiding, and the percentage of toiletings which were self-initiated. Greater improvement on all three measures was found with the chaining programme, although the difference was not significant for the accident measure.

The research reported here did not examine the particular aspects which were responsible for the increased effectiveness of the chaining programme. However, certain inferences can be drawn. Thus, building each response into the toileting sequence one at a time and ensuring that overlearning occurred for each skill as it was acquired, as well as for the entire sequence, seemed to account for some of the advantages of the chaining programme. This was indicated by the absence of the incorrect ordering of responses found during training with the Azrin and Foxx programme. In addition, conducting toileting trials only when involuntary voiding had begun probably ensured that bladder and bowel tension became the signal for toileting and that the muscle action required to bring about voiding was acquired. The success of this procedure was evidenced by the fact that nearly all toiletings during Study 2 resulted in voiding, whereas with the Azrin and Foxx procedures a high frequency of unsuccessful toiletings were encountered throughout training.

Other advantages of the chaining programme may be revealed by future comparisons of the two programmes in which changes in each component skill are measured. Further research is also needed to improve the procedures directed at the muscle action required to inhibit involuntary voiding, this being the skill which showed the least improvement during training with the chaining programme.

Toileting is only one of a number of complex motor skills which humans commonly use in their everyday life and which retarded persons often have difficulty learning. Little attention has been devoted to the factors which are involved in the development of skill and the control of movement among handicapped persons. Moreover, much of the experimental psychology of skill is concerned with the performance of non-handicapped persons who are already highly skilled (Connolly, 1975). Retarded persons frequently lack the sub-skills which are necessary for the development of complex skills, and they therefore require skills training which is different and more complex than the procedures which are effective with non-handicapped persons. The design of training procedures to facilitate the acquisition of complex motor skills would be considerably enhanced by a theoretical and experimental examination of the conditions necessary for all aspects of skill development.

Some of the conditions which are known to facilitate skilled performance in non-handicapped persons appear also to apply to the acquisition of self-toileting by retarded persons. Feedback, either as a sensory consequence of motor action, or in the form of knowledge of results provided by the trainer, appears to be a fundamental requirement (Deese & Hulse, 1967; Fitts, 1964). Moreover, feedback often needs to be augmented so that its discriminability is increased, especially during the early stages of learning when the sub-routines are being established (Connolly, 1975). This was achieved in the two toilet training programmes employed in the research reported here by the guidance procedure for the self-management tasks and by the alarms for voiding. Fitts (1964) cited several experiments which showed that augmentation of feedback usually results in reliable improvement in both performance and learning rate. He also suggested that the best results were achieved when discriminability involved more than one dimension.

An example of multi-dimensional feedback was provided in both toilet training programmes by the visual or auditory signal from the toilet alarm which accompanied the internal sensations at the onset of toilet voiding.

In future research it is possible that a similar augmentation of the results of the muscle action which inhibits involuntary voiding could be used to improve the acquisition of that skill. This might be achieved by the use of a bio-feedback device to provide a visual or auditory display corresponding to increased tension in the perineal muscles. Tangible or social rewards could also provide the necessary additional feedback. However, the research reported in this thesis suggests that feedback which is more directly related to the action being learned may be at least as effective, and may even override, the effects of reinforcement. If this is the case, designers of programmes for motor skill training should be more concerned to bring the natural feedback from motor responses into awareness than to find suitable extrinsic rewards.

Recognition of the relevant cues which precede each response is also essential to the acquisition of motor sequences (Connolly, 1975). Recognition may only occur if these cues are also augmented. In the chaining programme used in Study 2, additional cues were provided by the alarms and prompts, and training was also arranged so that both the natural bladder and bowel cues and the pants alarm tone were always present just prior to toilet voiding. The establishment of stimulus control has been discussed frequently in the applied psychology literature in relation to cue-reinforcer relationships (Kiernan, 1974), but rarely in relation to ensuring recognition of cues. This is an aspect of training which requires further research.

When one action is superimposed on another, successful performance may depend on both routines being highly overlearned (Fitts, 1964). Superimposed actions occur in self-toileting as well as in other skills. For example, the action which inhibits involuntary voiding must be maintained while the first three toileting tasks are carried out. Overlearning is also a necessary process in bringing about automatic performance, and should probably be programmed into any motor skill training. It has not been an important feature of training programmes for retarded persons. Its value may more readily be recognized as increasing attention is given to skill maintenance and generalization after training (Stokes & Baer, 1977).

The procedures which facilitate skill maintenance and generalization were not investigated in the research reported here. However, the degree of generalization to the natural environment was assessed in all three toilet training studies. The level of performance at the end of training was rarely evident at follow-up, although toileting was significantly better at follow-up than before training. This is a rather typical finding for studies of skill training with retarded persons (Baer & Stokes, 1977; J.M. Gardner, 1969). Procedures to bring about the satisfactory generalization of a number of skills already exist (Stokes & Baer, 1977). Similar procedures may also be found to be effective in relation to toileting once adequate acquisition has been achieved.

Another essential condition for successful performance of complex skills is the possession by the individual of all the component sub-skills which go to make up the complex skill. Although this may seem to be an obvious point, it has not generally been considered in relation to toileting. No toileting study could be found which reported pre-training assessments of all the component skills. In addition, most toilet training programmes, including the complex programme designed by Azrin and Foxx (1973b) have not specifically taught all of the skills in the toileting chain (see Chapter 6). Thus, attention to component skills assessment and training for the absent components would seem to be essential for successful acquisition of complex motor skills.

There is a growing literature on the technology of complex programme design and the implementation of such programmes (Kiernan, 1974, 1975).

Authors have generally emphasized goal setting, task analysis and sequential teaching. Task breakdown and the ordering of sequencing has usually been based on logical task analyses, analysed based on theory, or both. Besides being of practical value, training programmes also offer opportunities for both theory development and testing outside the laboratory (Kiernan, 1974).

The usefulness of programme evaluation in this regard is highlighted by the results of the toilet training studies reported here. Furthermore, failure to gain adequate control over the acquisition processes involved in the inhibition of voiding accidents opens the way for further theoretical analysis of the factors controlling bladder and bowel function.

A methodological issue of considerable importance to both research and training emerged during the research for this thesis. This issue related to the selection of response measures. One of the most valuable and unique contributions of behavioural science has been the quantification of behaviour so that its variation under systematic investigation could be reflected with reliability and sensitivity (Millenson, 1967). The study of behaviour which could be quantified in this way has led to the discovery of a range of well defined factors which operate on behaviour in the laboratory. Similarly, reliable and sensitive measures are necessary if we are to understand the factors which operate on complex human behaviour. Without such measures there is no reliable way of discovering how procedures affect the behaviour or even whether there is a genuine effect. A full range of sensitive measures is important whether analysis is for experimental or practical training purposes. For ethical reasons alone we should be able to show objectively whether the behavioural changes attempted are actually achieved.

The toilet training programmes and studies reported in the literature have been limited by the response measures used. A few have reported results in terms of only two or three specific measures (Brown & Brown, 1974; Connolly & McGoldrick, 1976; Hundziak et al., 1971; Madsen, Hoffman, Thomas, Koropsak & Madsen, 1969; Wolf, Risley, Johnston, Harris & Allen, 1967; Waye & Melnyr, 1973). Only two studies have reported a wider range of toileting measures (Mahoney, 1973; Wright, 1975). Accident rate has generally been the sole measure used in most toilet training ventures. This measure has proved to be misleading as an indicator of self-toileting performance. For instance, several authors have reported improved toileting with no accompanying decrease in accidents (Hundziak et al., 1971; Watson, 1968), and a similar pattern of responding was observed during Study 1.

Two solutions to the measurement problem were tried during the research reported here. The first solution was a composite measure which reflected small changes in several of the skills involved in toileting. A measure of this kind was provided by a standardized toileting scale based on ratings of behaviour in the natural environment (Balthazar, 1971), and was used as the main measure in Study 1. However, it did not reveal the differential training strategy effects which became apparent when several individual components of toileting were examined.

The second solution was to devise separate measures of each component skill. This was the measurement strategy used in Study 2. It enabled training effectiveness to be examined in some detail, and suggested directions for future research by revealing several acquisition problems which were not catered for in the two toilet training programmes. Moreover, the fact that reinforcement and its contingency were shown to have non-significant effects on each and every component skill, as well as on an overall measure such as training time, considerably increased the validity of these findings.

Devising a relevant array of response measures is important, not only in research, but also in relation to programme development in service settings. The research reported here indicates that evidence for overall improvement, or improvement in one aspect of a complex skill, may co-exist with problems in performance and learning, and serious programme deficiencies. Only experimental manipulation of single environmental conditions in relation to each component will isolate more effective procedures. Clearly a measure of each response in the chain is needed during this process. Even with an apparently effective set of procedures, however, there will be considerable variation in the way in which individuals respond during training. Some may have difficulty acquiring one or more of the responses because of past learning histories, or exhibit other behaviour which interferes with performance, or have some specific handicap in relation to certain responses. Continuous measurement of each response should make such problems obvious at the time they occur so that procedures can be altered to cope with them.

This thesis has shown that reinforcement principles are not the only, or perhaps even the most important factors determining the acquisition by retarded persons of complex motor skills such as toileting. It has also indicated that research into the learning processes involved in the acquisition of complex motor skills and the factors which control them, is feasible in an applied setting. A number of directions for future research have been suggested, many of which may facilitate collaboration between basic and applied research and theory development. Moreover, the increased effectiveness of service delivery coming from such research, and the resulting benefits for retarded persons, make the continuing investigation of training programmes a valuable enterprise.

LIST OF APPENDICES

LIST OF APPENDICES (continued)

APPENDIX 2.1. Medical Assessment Form: Organic conditions likely to interfere with the achievement of continence.

NAME: ______________________________ VILLA: ______________
(Christian names) (Surname)

MEDICAL OFFICER: ______________________________ DATE: __________

A. Circle the appropriate answer to the following questions.
Note: If you circle YES for any one of these questions there is no need to complete the rest of the assessment.

	Question	Answer	
1.	Has poorly controlled epilepsy (more than 5 seizures per month during the last 3 months).	YES	NO
2.	Has spinal cord problems and possible associated neurogenic bladder.	YES	NO
3.	Has chronic constipation or frequent diarrhoea.	YES	NO
4.	Has coeliac disease.	YES	NO
5.	Has a physical handicap which interferes significantly with walking (cannot walk across a room unsupported).	YES	NO
6.	Has a physical handicap which interferes significantly with hand use (both hands are unable to grasp and let go voluntarily).	YES	NO
7.	Has significant visual deficit (cannot see enough to recognize a person).	YES	NO
8.	Has significant hearing problems (cannot hear normal speech).	YES	NO

B. If the answers to questions 1-8 Part A are NO, complete the following tests.

1. Rectal examination.
   Results:

2. Ward urinalysis (including specific gravity).
   Results:

3. Micro-urine and culture.
   Results:

4. Multi 12 (for check of urea and creatinine levels).
   Results:

COMMENTS: (Any other factors which may make this subject unsuitable for intensive toilet training).

APPENDIX 2.2. The major questions asked during the survey of incontinence at Strathmont Centre.

1. Does ______ ever urinate or defecate in the toilet?

2. If yes, estimate how often.
   a) per day, or
   b) per week, or
   c) per fortnight.

3. Is ______ ever wet or soiled during the day?

4. Is ______ ever wet or soiled during the night?

5. If yes to 3 or 4, estimate how often.
   a) per day, or
   b) per week, or
   c) per fortnight.

6. Under what circumstances is ______ wet or dirty?
   a) during epileptic fit
   b) could not get to the toilet (locked doors, no toilets nearby, other people prevented him/her from getting to the toilet)
   c) only a damp patch or slight smear on the pants
   d) temporary bowel or bladder infection resulting in inability to hold urine or faeces
   e) other.

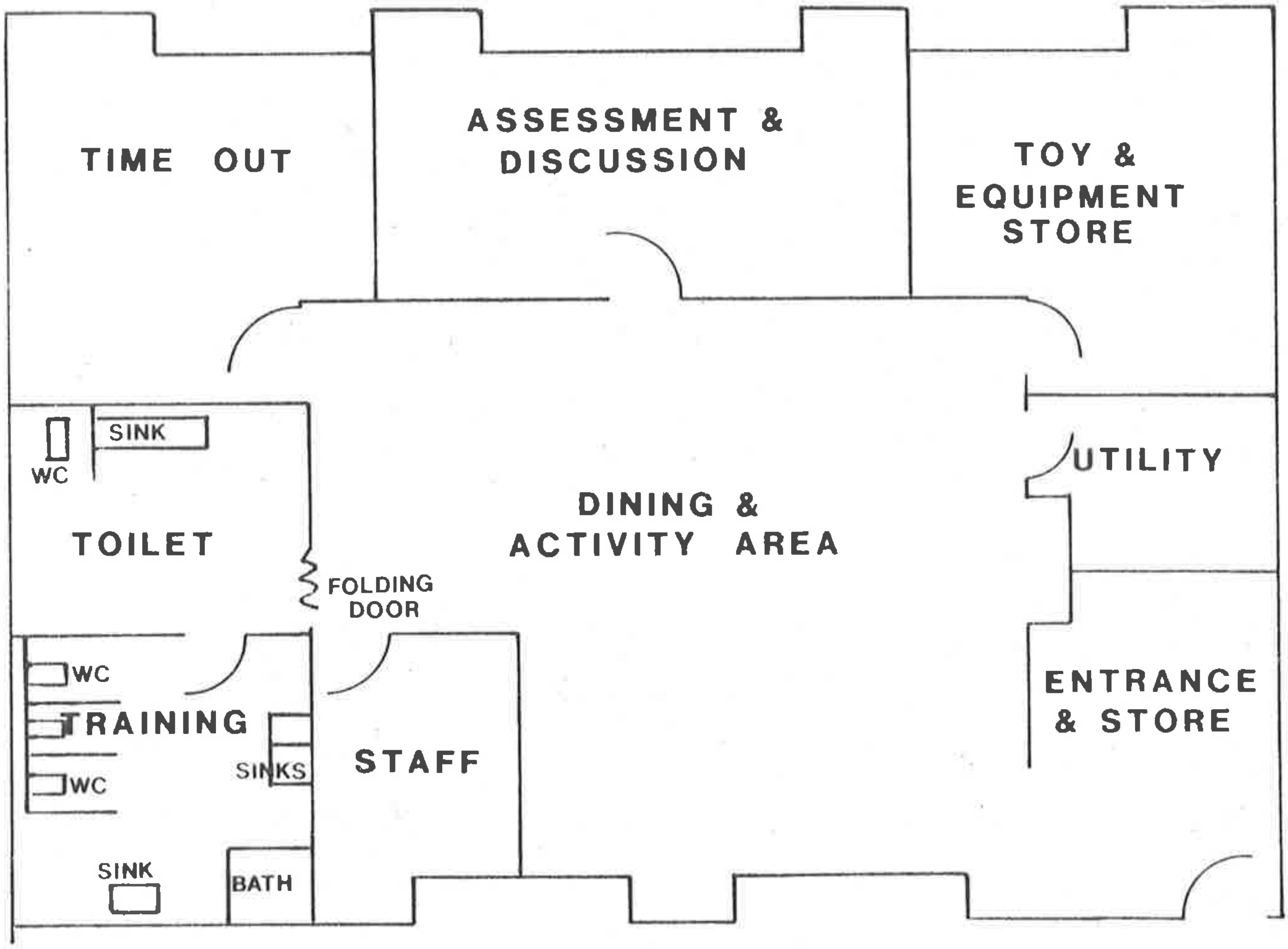
7. Does ______ take him/her-self to the toilet?

8. If yes, estimate how often.
   a) per day, or
   b) per week, or
   c) per fortnight.

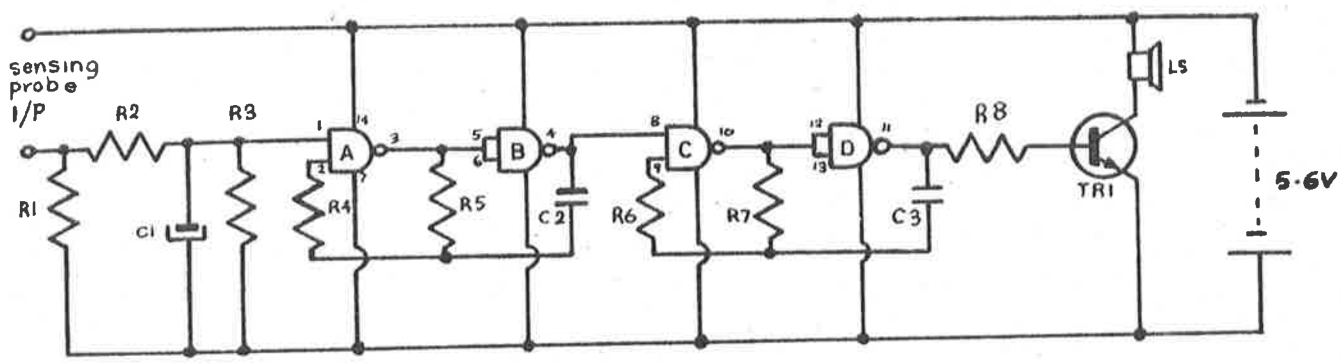
9. Does ______ ever indicate that he/she needs to go to the toilet?

10. If yes, estimate how often.
    a) per day, or
    b) per week, or
    c) per fortnight.

APPENDIX 5.1. Floor plan of the training unit used for the Azrin and Foxx programme.



APPENDIX 5.2. Electronic schematic of the alarm circuit.



Resistors

R1	100K	R5	3.9M
R2	100K	R6	2.7M
R3	omit	R7	220K
R4	10M	R8	10K

Capacitors

C1	0.82µf
C2	0.015µf
C3	0.001µf

Misc.

LS	STC	200930
IC1	A-D	4011
TR1	BC	107

APPENDIX 5.3. Observation checklist used to record follow-up observations for the pilot study of the Azrin and Foxx toilet training procedures.

Resident's Name: ______________________________ Villa: _____________

Date: _____________

A. Hourly pants check

Record the following: W = wet or dirty
D = dry and clean
W* = unavoidable accident (e.g. toilets inaccessible)

Note: Also record accidents as W or W* if detected between hourly checks.

Time	9 am	10 am	11 am	12.00	1 pm	2 pm	3 pm	4 pm	5 pm
Record									

B. Record of toilet behaviour

Tick appropriate boxes for each event. Note time of each toileting.

1. TOILET APPROACH

Time Went with no direction Followed other residents Sent by staff Taken by staff Other (briefly explain)										

2. PANTS DOWN

Completely by self Not clear of toilet seat Pulled down with help Pulled to ankles Taken right off Not pulled down Pulled down by staff Other (briefly explain)										

3. TOILET SITTING

Sat by self Sat in incorrect position Help given Sat on by staff Other (briefly explain)										

APPENDIX 5.3. cont.

4. VOIDING IN TOILET

All went in toilet Some on toilet seat Most voided outside toilet Did not void Other (briefly explain)										

5. STOOD FROM TOILET

Had completed voiding Stood while voiding Stood with help Lifted by staff Stayed sitting for 20 min. or more Other (briefly explain)										

6. PANTS UP

Completely be self Not pulled up to waist Outer garments left behind Pulled up with help Pulled up by staff Other (briefly explain)										

7. TOILET FLUSHING

Pushed button by self Pushed button but incomplete flushing Pushed button with help Button pushed by staff Button not pushed Other (briefly explain)										

8. UNACCEPTABLE BEHAVIOUR

Put hand in toilet Flapped lid or seat Head in toilet Hand in faeces or urine Smeared faeces or urine Other (briefly explain)										

COMMENTS

APPENDIX 6.1. Diagnosis, aetiology, additional problems and ongoing treatment for the thirty-two children who were subjects in Study 1.

GROUP	TRAINEE	DIAGNOSIS & AETIOLOGY	ADDITIONAL PROBLEMS	ONGOING TREATMENT
1	1	Severe mental retardation due to anoxia at birth & prenatal trauma.	Squint, little speech, uncontrolled gait.	Spectacles, both legs in calipers.
	2	Severe mental retardation due to perinatal trauma.	Mild spastic hemiplaegia, no speech.	Carbamazepine, Lyndiol, Meronidarole, caliper on one leg.
	3	Profound to severe mental retardation of unknown aetiology.	Epileptic, no speech, extremely withdrawn.	Phenytoin, Benzotropine.
	4	Moderate mental retardation of unknown aetiology.	Bilateral brain damage, epilepsy, prolapsed bowel, unsteady gait, no speech.	None
2	5	Moderate mental retardation due to brain damage as a result of child abuse.	Hyperactive, behaviour problems, frequent temper tantrums, self-abusive, some echolalic speech.	Phenytoin, Haloperidol.
	6	Severe mental retardation due to San Fillipo Syndrome.	Passive, no speech, deteriorating.	None
	7	Severe mental retardation due to either prenatal trauma or post-encephalitis brain damage in infancy. Cortical atrophy.	Epileptic, hyperactive, temper tantrums, no speech.	Thioridazine, Carbamazepine.
	8	Moderate retardation due to congenital left Horner's Syndrome.	Epileptic, mild general hypertonia, hypertrophy of the gums.	Phenytoin, Carbamazepine, Dilantin, Primidone.

APPENDIX 6.1. cont.

GROUP	TRAINEE	DIAGNOSIS & AETIOLOGY	ADDITIONAL PROBLEMS	ONGOING TREATMENT
3	9	Severe mental retardation due to hydrocephalus and post-encephalitis brain damage in adolescence.	History of periods of dribble incontinence of unknown cause, some echolalic speech.	None.
	10	Severe to moderate mental retardation due to rubella in pregnancy. Premature birth, microcephaly.	Partial hearing loss, hyperactive, temper tantrums, self-abusive no speech.	None.
	11	Severe to moderate mental retardation due to prenatal anoxia.	Severe, frequent temper tantrums, self-abusive, attention seeking, no speech.	Thioridazine.
	12	Severe mental retardation. Down's Syndrome.	Ventricular septal defect, no speech, withdrawn.	None.
4	13	Severe mental retardation due to unknown aetiology.	Diffuse abnormal EEG, some echolalic speech.	None.
	14	Severe mental retardation. Down's Syndrome.	Impetigo, no speech.	None.
	15	Moderate mental retardation due to prenatal trauma.	Multiple physical deformities, irregular kidney dysfunction, non-functioning left kidney, inability to concentrate urine, dribble incontinence, impetigo, some speech, dependent.	Calipers on both legs.
	16	Severe mental retardation of unknown aetiology.	Abnormal EEG, hyperactive, uncoordinated, no speech.	None.

APPENDIX 6.1. cont.

GROUP	TRAINEE	DIAGNOSIS & AETIOLOGY	ADDITIONAL PROBLEMS	ONGOING TREATMENT
5	17	Moderate mental retardation due to Phenylketonuria.	Withdrawn, no speech, self-abusive, tiptoe gait.	Calipers on both legs, regular postural drainage.
	18	Severe mental retardation possibly due to prenatal trauma.	Epileptic, brain damage, hyperactive, self-abusive, smears faeces, behaviour problems, no speech.	Thioridazine, Haloperidol.
	19	Profound to severe mental retardation due to unknown aetiology. Cerebral agenisis.	Epileptic, withdrawn, unsteady gait, no speech.	Phenytoin.
	20	Severe mental retardation due to unknown aetiology. Cultural, familial.	Epileptic, behaviour problems, temper tantrums, self-abusive, no speech.	Helmet for head-banging, Phenytoin, Thioridazine, Diazepan.
6	21	Profound mental retardation due to brain damage of uncertain origin.	Epileptic, hypertonia, stooped and twisted, withdrawn, no speech.	Calipers on both legs, Phenytoin.
	22	Severe mental retardation with autistic features due to unknown aetiology.	Moderate diffuse abnormal EEG with epileptic potential, hyperactive, temper tantrums, no speech, stereotyped activity.	Trifluoperazine, Thioridazine, Phenytoin, attends Autistic Children's Centre for Schooling.
	23	Profound mental retardation of unknown aetiology.	Mild spastic quadriplegia, anocardia with occasional cerebral abcesses, no speech.	Thioridazine.
	24	Severe to moderate mental retardation. Seckel's Syndrome, microcephaly.	Growth retardation, webbing of digits, dependent, some speech.	None.

APPENDIX 6.1. cont.

GROUP	TRAINEE	DIAGNOSIS & AETIOLOGY	ADDITIONAL PROBLEMS	ONGOING TREATMENT
7	25	Severe to moderate mental retardation. Cultural-familial.	Epileptic, mildly abnormal EEG, some speech.	None.
	26	Severe mental retardation due to unknown aetiology.	Abnormal EEG with bilateral brain damage and epileptic potential.	None.
	27	Severe mental retardation. San Fillipo Syndrome.	Unsteady gait, withdrawn, deteriorating, no speech.	Haloperidol.
	28	Severe mental retardation of unknown origin.	Epileptic, no speech.	Phenytoin.
8	29	Moderate mental retardation due to congenital abnormality of the anterior mesoderm.	Multiple deformities of the face, impetigo, some speech.	None.
	30	Severe to moderate mental retardation. Down's Syndrome.	Minor brain damage, withdrawn, no speech.	None.
	31	Severe mental retardation of unknown aetiology.	Epileptic, spastic quadriplegia, with one arm almost useless, no speech.	Calipers on both legs, Primidone, Carbamazepine.
	32	Profound mental retardation of unknown aetiology.	Epileptic, abnormal EEG, short sighted, no speech, withdrawn, unsteady gait.	Sulthiane, Phenytoin, Carbamazepine.

APPENDIX 6.2. Individual subjects' improvement scores on the Balthazar toileting scale in Study 1.

GROUP	S	DAY TIME TOILETING		NIGHT TIME TOILETING	
		AFTER TRAINING	AT FOLLOW-UP	AFTER TRAINING	AT FOLLOW-UP
1	1	32	14	17	12
	2	- 1	- 7	0	1
	3	1	- 3	- 4	3
	4	7	- 3	-12	-
2	5	15	16	6	- 2
	6	7	-	9	-
	7	11	15	-10	0
	8	18	1	-	-
3	9	3	10	-16	-20
	10	- 8	17	4	- 7
	11	3	- 4	0	- 8
	12	4	6	- 6	6
4	13	14	6	8	- 8
	14	20	28	10	20
	15	16	13	- 4	- 5
	16	1	- 4	- 5	0
5	17	24	25	16	14
	18	-12	-18	- 9	1
	19	0	10	- 5	- 6
	20	5	20	14	14
6	21	30	4	10	5
	22	2	19	- 6	4
	23	- 7	9	-	40
	24	16	26	20	8
7	25	13	4	0	10
	26	4	- 6	- 4	-11
	27	4	10	- 4	- 5
	28	-11	-20	0	20
8	29	12	28	5	10
	30	28	8	-20	-10
	31	9	7	-30	31
	32	- 6	6	- 1	4

APPENDIX 6.3. Analysis of variance of improvement scores on the Balthazar day time and night time scales after training showing the effects of the three training strategies.

Source	Improvement in day time Balthazar scores		Improvement in night time Balthazar scores	
	MEAN SQUARE	F(df=1,28)	MEAN SQUARE	F(df=1,28)
Contingency	32.00	0.25	0.78	0.01
Guidance	55.13	0.44	442.53	3.81
Alarms	435.13	3.45	3.78	0.03
Residual error[a]	125.99		116.09	

[a] All interaction terms were pooled with the error term since they were not significantly different with $\alpha=.20$, and it was considered appropriate to increase the degrees of freedom for the error term in this way (Winer, 1971, p. 378-384). Consequently the degrees of freedom vary accordingly.

Note: No F ratios were significant.

APPENDIX 6.4. Analysis of variance of improvement scores on the Balthazar day time and night time toileting scales at follow-up showing the effects of the three training strategies.

Source	Improvement in day time Balthazar scores		Improvement in night time Balthazar scores	
	MEAN SQUARE	F(df=1,28)	MEAN SQUARE	F(df=1,28)
Contingency	8.00	0.06	253.13	2.10
Guidance	28.13	0.21	325.13	2.69
Alarms	595.13	4.35*	15.13	0.13
Residual error[a]	136.67		120.84	

[a] All interaction terms were pooled with the error term since they were not significantly different with $\alpha=.20$, and it was considered appropriate to increase the degrees of freedom for the error term in this way (Winer, 1971, p. 378-384). Consequently the degrees of freedom vary accordingly.

* $p < .05$

.PPENDIX 6.5. Sample record sheets used in Study 1.

BLADDER TRAINING PHASE

tart exactly on the half-hour, for example 9.00 or 9.30.

tarting Time: ______________ Resident's Name: ______________________________ Date: __________

heck under the appropriate item when completed.

	9.00	9.30	10.00	10.30	11.00	11.30	12.00	12.30	1.00	1.30	2.00	2.30	3.00	3.30	4.00	4.30
ime of cleanliness training and positive practice)																
umber of edibles and praise when not voiding or aving pants checked)																
. Give as much fluid as resident would drink while seated in his chair. Note number of cups of fluid consumed.																
(a) Waited about 1 minute.																
. Directed resident to toilet using the minimal possible prompt. (Took resident to toilet.)																
. Directed resident to pull his pants down using the minimal possible prompt. (Pulled resident's pants down.)																
. <u>If resident voided</u> (a) Gave edibles and praise while he was seated then directed him to stand. (Stood resident up.)																
(b) Directed resident to flush toilet using the minimal possible prompt. (Flushed toilet for resident.)																
'c) Note each time toilet voiding began.																
<u>If resident did not void</u> within 20 minutes of drinking fluids, directed him to stand. (Stood him up.)																

	9.00	9.30	10.00	10.30	11.00	11.30	12.00	12.30	1.00	1.30	2.00	2.30	3.00	3.30	4.00	4.30
6. Directed resident to pull up his pants using the minimal possible prompt. (Pulled resident's pants up.)																
7. Directed resident to his chair using the minimal possible prompt. (Took resident to his chair.)																
8. Inspected resident for dry pants 5 minutes after he had been sitting and every 5 minutes thereafter, giving edibles and praise if pants were dry.																
9. <u>If accident occurred</u> Gave brief cleanliness training and positive practice. (Changed resident's pants and cleaned up.)																
(b) Note exact time of accident.																

Continuously praise resident for being dry. When self-initiation occurs, start the self-initiation procedure and chart.

Exact time of first self-initiation: ____________________

Note: Instructions in brackets refer to the procedures used during control conditions.

APPENDIX 6.5 cont.

SELF-INITIATION PHASE

Resident walks to toilet himself.

Resident's Name: ______________________ Date: ____________

Check under the appropriate item when completed	1	2	3	4	5	6	7	8	9	10
(Time of full cleanliness training and positive practice)										
(Number of edibles and praise when not voiding or having pants checked)										
1. Time self-initiation occurred.										
2. If resident had trouble lowering his pants gave minimal prompt. (Pulled them down.)										
3. <u>If resident voided</u> gave edible and praise while seated, allowed him to get up on his own and gave minimal prompt to flush toilet. (Got him to stand and flushed toilet.)			Give no edible		Give no edible			Give no edible		
4. <u>If resident did not void</u> Allowed him to get up on his own. (Got him to stand.)										
5. If resident had trouble rasing his pants gave minimal prompt. (Pulled them up.)										
6. Moved resident's chair further from toilet.										
7. Directed resident to his chair. (Took resident to his chair.)										
8. Gave resident fluids.						Give no fluids			Give no fluids	

If at least 9 out of 10 voidings are self-initiated in the toilet, discontinue training - begin maintenance.

APPENDIX 6.5 cont.

	1	2	3	4	5	6	7	8	9	10
9. Inspected resident for dry pants at the appropriate times; gave edible and praise if pants dry.	5	10	20	E 30 M I	V E 45 N U	R Y 60 T E	S 90	120	120	120
10. <u>If accident occurred</u> (a) Gave full cleanliness training and positive practice. (Changed residents pants and cleaned up.)										
(b) Note exact time of accident.										

Note: Instructions in brackets refer to procedures used during control conditions.

APPENDIX 6.5 cont.

General Guidelines for fading prompts.

1. Determine the minimal prompt the resident responds to. This may be a touch, pointing toward the toilet, or an instruction.
2. Use a less active prompt the next time the resident is prompted to the toilet.
3. Wait a few seconds after the prompt before giving graduated guidance.
4. The sequence of prompts for each task are listed below from most active to least active. The resident will usually begin independently toileting himself before the least active prompt is given.
5. Mark with a cross the step you begin with and each step as you begin to use it.

TOILET APPROACH PROMPTS

Resdident's Name:________________

PROMPT	EXAMPLE
1. Verbal instruction + Gesture + Touch	"John, go to the toilet" Point to the toilet Lightly tug at resident's shirt (guide him from his chair to the toilet if necessary)
2. Verbal instruction + Gesture No touch	"John, go to the toilet" Point to the toilet
3. Reduced verbal instruction + Gesture No touch	"John, toilet" Point to the toilet
4. Reduced verbal instruction + Gesture No touch	"Toilet" Point to the toilet
5. No verbal instruction Gesture No touch	Point to the toilet with your arm fully extended and motion toward the toilet with your head
6. No verbal instruction Reduced gesture No touch	Point to the toilet with your arm partially extended and full head motion
7. No verbal instruction Reduced gesture (no arm motion) No touch	Point to the toilet with full head motion

APPENDIX 6.5 cont.

PROMPT	EXAMPLE
8. No verbal instruction Reduced gesture No touch	Motion toward the toilet with your head
9. No verbal instruction Reduced gesture (no head motion) No touch	Move your eyes toward the toilet
10. No verbal instruction No gesture No touch	Toilet-approach self-initiated

APPENDIX 6.5 cont.

PROMPTS FOR PANTS DOWN

Resident's Name: ____________________

Note: The resident should pull his pants down to his knees.

PROMPT	EXAMPLE
1. Verbal instruction + Gesture + Touch	"John, pants down" Point to resident's pants Grasp resident's hands around the waistband of his pants and use graduated guidance to guide him in pulling them down
2. Reduced verbal instruction + Gesture + Touch	"Pants down" Point to resident's pants Grasp resident's hands around the waistband of his pants if necessary and use graduated guidance to guide him in pulling them down
3. Reduced verbal instruction + Gesture + Reduced touch	"Down" Point to resident's pants Guide resident's hands to the waistband of his pants if necessary
4 No verbal instruction Reduced gesture + Touch, if necessary	Look at resident's pants Guide resident's hands to waistband if necessary
5. No verbal instruction Reduced gesture No touch	Look at resident's pamts
6. No verbal instruction No gesture No touch	Pulling pants down self-initiated

APPENDIX 6.5 cont.

TOILET SITTING AND STANDING PROMPTS

Resident's Name: ____________________

PROMPT	EXAMPLE
1. Verbal instruction + Gesture + Touch	"John, sit down" ("stand up") Point to (away from) the toilet seat Grasp resident by the shoulders and use graduated guidance to guide him to sit (stand)
2. Verbal instruction + Gesture No touch	"John, sit down" ("stand up") Point to (away from) the toilet seat
3. Reduced verbal instruction + Gesture No touch	"John sit" ("stand") Point to (away from) the toilet seat
4. Reduced verbal instruction + Gesture No touch	"sit" ("stand") Point to (away from) the toilet seat
5. No verbal instruction Gesture No touch	Point to (away from) the toilet seat with your arm extended and motion towards the seat with your head.
6. No verbal instruction Reduced gesture No touch	Point to (away from) the seat with your arm partially extended and full head motion
7. No verbal instruction Reduced gesture (no arm motion) No touch	Point to (away from) the seat with full head motion
8. No verbal instruction Reduced gesture No touch	Motion toward (away from) the seat with your head
9. No verbal instruction Reduced gesture (no head motion) No touch	Move your eyes toward (away from) the seat
10. No verbal instruction No gesture No touch	Sitting (standing) self-initiated

Note: Instructions in brackets refer to the procedures for standing.

APPENDIX 6.5 cont.

PROMPTS FOR PANTS UP

Note: Since the resident's pants are below his knee, it will be easier for him to pull them up if he bends forward slightly.

PROMPT	EXAMPLE
1. Verbal instruction + Gesture + Touch	"John, pants up" Point to resident's pants Place your hands over resident's hands and use graduated guidance to guide his hands to the waistband of his pants and to pull them up
2. Reduced verbal instruction + Gesture + Touch	"Pants up" Point to resident's pants Grasp resident's hands around the waistband of his pants and use graduated guidance to guide him in pulling them up
3. Reduced verbal instruction + Gesture + Reduced touch	"Up" Point to resident's pants Guide resident's hands to waistband if necessary
4. No verbal instruction Reduced gesture + Touch, if necessary	Look at resident's pants Guide resident's hands to waistband if necessary
5. No verbal instruction Gesture No touch	Look at resident's pants
6. No verbal instruction No gesture No touch	Pulling pants up self-initiated

Note: Add outer garments when all the above steps completed.

APPENDIX 6.5 cont.

TOILET FLUSHING PROMPTS

Resident's Name: ____________________

PROMPT	EXAMPLE
1. Verbal instruction + Gesture + Touch	"John, push the button" Point to the button Grasp resident's hand and use graduated guidance to guide him in pushing the button
2. Verbal instruction + Gesture No touch	"John, push the button" Point to the button
3. Reduced verbal instruction + Gesture No touch	"John, button" Point to the button
4. Reduced verbal instruction + Gesture No touch	"Button" Point to the button
5. No verbal instruction Gesture No touch	Point to the button with your arm fully extended and motion towards the button with your head
6. No verbal instruction Reduced gesture No touch	Point to the button with your arm partially extended and full head motion
7. No verbal instruction Reduced gesture (no arm motion) No touch	Point to the button with full head motion
8. No verbal instruction Reduced gesture No touch	Motion toward the button with your head
9. No verbal instruction Reduced gesture (no head motion) No touch	Move your eyes toward the button
10. No verbal instruction No gesture No touch	Flushing self-initiated

APPENDIX 6.5 cont.

DIRECTIONS FOR MAINTAINING INDEPENDENT TOILETING AFTER TRAINING

Children Trained

____

____

____

____

Once a person has learned to look after his toileting all by himself he needs some help from you until this new learning is fully established as a permanent part of his style of life. The following notes are intended to help you to give the newly trained children the help they need.

1. Many of the children will have a few accidents until they are sure that all staff expect them to be fully continent and look after themselves.

2. * DO NOT prompt or remind these children to go to the toilet at any time. If you do they will wait for your reminders and lose their independence.

3. * DO NOT take these children to the toilet when other children are being taken. If you do they will rely on you and lose their independence.

4. MAKE SURE that these children have free access to toilets at all times. If you do not they will slip back into their past pattern of accidents.

5. MAKE SURE that these children are wearing clothing which they can raise and lower easily. (Trousers with elastic waist).

6. MAKE SURE that these children know where the toilets are in any setting to which they go outside the villa. You can do this by showing them and then taking them to different places away from these toilets and asking them to go to the toilet. Only by them demonstrating in this way that they understand will you be sure that they can find the toilets. Praise them for finding the toilet correctly.

7. Until these children have had no accidents for 2 weeks, check whether their pants are wet or dirty at regular intervals. Praise them for having dry pants.

8. Even after these children are completely continent for 2 weeks it is important to praise them on some occasions for staying dry and using the toilet. This is because they see many other children receiving attention when they have accidents.

9. * Whenever one of these children has an accident or is discovered wet or dirty, carry out the following procedure:-

   (a) Grasp him by the shoulders so that he is looking at you and say, "No, you wet your pants." Show displeasure in your face.

   (b) Direct him to wipe or mop up the urine or faeces for 15 minutes. Mop anywhere if there is not enought mess to take 15 minutes.

APPENDIX 6.5 cont.

(c) Direct him from 6 different places, one after the other, to go to the toilet, pull his pants down, sit for a few seconds, stand, replace clothing and walk out.

(d) Direct him to take off his wet or soiled clothing and put them in the linen bag.

(e) Direct him to wipe himself clean.

(f) Diect him to get clean clothing.

(g) Direct him to put on his clean clothing.

10. If this cleanliness training and practice is near a meal or snack time or bed time, delay these events for up to 1 hour. Tell him why. If near snack time do not give him snack and tell him why.

11. When requiring the children to go through the cleanliness training and practice, be matter of fact and only prompt them after a few seconds have elapsed following your direction.

12. If the children have difficulty performing any of the cleanliness training and practice tasks after you have directed them, gently guide their hands, but take your guidance away as soon as they begin to move in the right direction themselves. This will prevent the children from depending on you to guide them. Keep interaction to a minimum. After showing your initial displeasure be matter of fact.

13. MAKE SURE that you keep a record on the record sheets provided, of every pants check you make and whether the children were dry or wet or dirty. This will tell you at a glance whether the children are improving.

14. If there are any problems or if the number of accidents are increasing, contact ________________ immediately.

15. The toilet training staff and Mrs. Bettison will frequently visit your villa to see how the children are progressing and to look at the records.

16. THE VILLA CHARGE AND DEPUTY will ensure that any new members of the villa staff, who work with these children, know how to follow these procedures.

17. THE VILLA CHARGE AND DEPUTY will sign the record forms at the end of each day shift and will assign a specific member of staff to be responsible for the procedure and records each day.

P. McElwaine
NURSING SUPERINTENDENT

Sue Bettison
PSYCHOLOGIST

* If an accident is detected and there are no staff free to carry out the accident procedure ignore it until one of you is free, note the time the accident was detected then carry out the accident procedure as soon as possible.

* Between 8.30 a.m. and 5.00 p.m. Monday to Friday one of the toilet training staff is available at all times to come to your villa and carry out the procedure for you.

APPENDIX 6.5 cont.

* If the accident is on the floor (pants were pulled down) or all over the pants when the resident went to the toilet still treat it as an accident.

* Any accident which occurs in a situation where the resident has no access to the toilet is to be recorded, but do not carry out the accident procedure. Just ask him/her to change pants and clean up if possible.

APPENDIX 6.5 cont.

DAILY MAINTENANCE RECORD

Date: ____________________ Checked by: ____________________

Assisted by: ____________________

Where checked: ____________________

Daily Dry-Pants Inspection Record.

STAFF INITIALS WHEN COMPLETED	Before breakfast check	Mid-morning snack check	Before lunch check	Mid-afternoon snack check	Before tea check	Before bed check
	____	____	____	____	____	____

1. Praise resident if he is found dry and clean.
2. If you notice the resident is wet or dirty at any other time carry out the same procedure.

- - - - - - - - - - - - - - - - - -

Daily Accident Chart

(If an accident was unavoidable, place an asterisk beside the resident's name and write a note to explain.)

Resident's Name	Time found out	Starting time for full cleanliness training and positive practice	Meal delayed	Bedtime delayed	Snack missed	Initial when completed

APPENDIX 6.5 cont.

MONTHLY ACCIDENT CHART DURING MAINTENANCE

Villa ____________

Instructions:

1. Fill in the name of the resident on the maintenance programme and record the month where indicated.
2. Under the appropriate day record the number of accidents each resident had on that day. If none were detected, record a zero.
3. Do not record accidents that are marked with an asterisk as unavoidable on the Daily Maintenance Record.

Resident's name: ____________________________

DAY

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total accidents for the month

APPENDIX 6.6. Analysis of variance for average number of days in training showing the effects of the three training strategies.

SOURCE	MEAN SQUARE	F(df = 1, 24)
Pre-training Balthazar day time toileting score (as covariate)	1131.69	16.96 ***
Contingency (A)	58.13	0.87
Guidance (B)	32.21	0.48
Alarms	169.36	2.54
A x B	420.52	6.30 *

Note: The three-way interaction term was pooled with the error term since it was not significantly different with $\alpha = .20$ and it was considered appropriate to increase the degrees of freedom for the error term in this way (Winer, 1971, p. 378-384). Consequently, the degrees of freedom vary accordingly.

* $p < .05$

*** $p < .001$

APPENDIX 6.7. Analysis of variance for improvement scores on <u>percent self-initiated toiletings/total toilet uses</u> at the end of training showing the effects of the three training strategies.

SOURCE	MEAN SQUARE	F(df = 1, 27)
Pre-training Balthazar day time toileting score (as covariate)	6629.71	5.82 *
Contingency	1622.08	1.42
Guidance	877.10	0.77
Alarms	0.69	0.00
Residual error[a]	1139.28	

[a] All interaction terms were pooled with the error term since they were not significantly different with $\alpha = .20$ and it was considered appropriate to increase the degrees of freedom for the error term in this way (Winer, 1971, p 378-384). Consequently, the degrees of freedom vary accordingly.

* $p < .05$

APPENDIX 6.8. Analysis of variance for improvement scores on percent accidents/total voidings at the end of training, showing the effects of the three training strategies.

SOURCE	MEAN SQUARE	F(df = 1,24)
Contingency (A)	242.00	1.56
Guidance (B)	28.13	0.18
Alarms (C)	36.13	0.23
A x B	612.50	3.94
A x C	72.00	0.46
B x C	465.13	2.99
A x B x C	480.50	3.09

Note: No F values were significant

APPENDIX 6.9. Analysis of variance for improvement scores on percent toilet voidings/total toiletings at the end of training showing the effects of the three training strategies.

SOURCE	MEAN SQUARE	F(df = 1,24)
Contingency (A)	21.13	0.14
Guidance (B)	32.00	0.21
Alarms (C)	112.50	0.74
A x B	190.13	1.25
A x C	3.13	0.02
B x C	60.50	0.40
A x B x C	496.13	3.26

Note: No F values were significant

APPENDIX 6.10. Analysis of variance for improvement scores on estimated time in minutes taken to perform the first four toileting tasks at the end of training showing the effects of the three training strategies.

SOURCE	MEAN SQUARES	F(df = 1, 25)
Contingency (A)	45.13	7.32 *
Guidance (B)	0.50	0.08
Alarms (C)	4.50	0.73
A x B	21.13	3.43
A x C	0.13	0.02
B x C	32.00	5.19 *

Note: The three way interaction term was pooled with the error term since it was not significantly different with $\alpha = .20$, and it was considered appropriate to increase the degrees of freedom for the error term in this way (Winer, 1971, p. 378-384). Consequently, the degrees of freedom vary accordingly.

* $p < .05$

APPENDIX 6.11. Analysis of variance for mean ratings of performance on six self-management tasks combined at the end on training, showing the effects of the three training strategies.

SOURCE	MEAN SQUARES	F(df = 1, 27)
Pre-training Balthazar day time toileting score (as covariate)	438.05	15.07 ***
Contingency	5.28	0.16
Guidance	192.64	5.83 *
Alarms	69.03	2.09
Residual error[a]	33.05	

[a] All interaction terms were pooled with the error term since they were not significantly different with $\alpha = .20$, and it was considered appropriate to increase the degrees of freedom for the error term in this way (Winer, 1971, p. 378-384). Consequently, the degrees of freedom vary accordingly.

* $p < .05$

*** $p = .001$

APPENDIX 6.12. Individual subjects' scores on six measures of toileting performance during training in Study 1.

GROUP	S	NUMBER OF DAYS IN TRAINING	INDEPENDENCE IN SELF-MANAGEMENT TASKS AT END OF TRAINING	IMPROVEMENT IN PERCENTAGE OF VOIDINGS WHICH WERE ACCIDENTS	IMPROVEMENT IN PERCENTAGE OF TOILETINGS WHICH RESULTED IN VOIDINGS	IMPROVEMENT IN PERCENTAGE OF TOILET VOIDINGS WHICH WERE SELF-INITIATED	IMPROVEMENT IN ESTIMATED TIME TO PERFORM THE FIRST FOUR TOILETING TASKS
1	1	5	24	-19	0[a]	78	12
	2	5	24	-11	0[a]	43	2
	3	28	6	-5	4	0	3
	4	3	21	18	-20	56	6
2	5	25	23	8	-7	15	2
	6	28	10	19	18	0	1
	7	18	24	14	14	53	5
	8	13	24	7	14	21	1
3	9	28	20	-5	0	-45	-1
	10	14	20	-13	4	62	5
	11	5	24	7	19	80	3
	12	28	2	13	-8	-1	-1
4	13	28	20	-27	7	30	5
	14	5	24	6	0[a]	100	4
	15	28	20	-3	-2	14	1
	16	28	12	-32	-20	27	5
5	17	28	23	7	3	-8	0
	18	28	23	-13	-10	5	0
	19	28	14	2	-6	0	2
	20	14	21	17	0[a]	50	2
6	21	28	20	2	-7	1	-1
	22	28	24	-6	-8	4	0
	23	28	21	-1	-1	-2	-3
	24	28	23	-3	0[a]	-1	0
7	25	5	24	33	0[a]	25	2
	26	28	2	-4	-7	0	1
	27	28	2	11	1	0	1
	28	6	20	0[a]	0[a]	83	3
8	29	28	20	12	45	-2	0
	30	3	21	9	0[a]	100	4
	31	2	24	0[a]	0[a]	60	5
	32	28	6	-1	-13	0	-1

[a] These children performed at mastery level at the beginning of training and continued to do so throughout training. Therefore no improvement was possible.

APPENDIX 7.1. Diagnosis, aetiology, additional problems and ongoing treatment for the eighteen children who were subjects in Study 2.

TRAINING GROUP	CHILD	DIAGNOSIS & AETIOLOGY	ADDITIONAL PROBLEMS	ONGOING TREATMENT
Contingent reinforcement	1	Moderate mental retardation, Down's Syndrome.	Ventriculo septal defect, pulmonary hypertension, no speech, urethral stricture successfully treated by excising urethral diverticulum 3 years before training.	None.
	2	Moderate mental retardation due to unknown prenatal influence and infarcted placenta, Microcephaly.	Unsupervised most of the time at home, no speech, frequent bouts of diarrhoea.	Speech therapy once a week, metamucil.
	3	Severe mental retardation due to perinatal anoxia.	No speech, violent and self-abusive outbursts.	Thioridazine, diazepam, pericyazine.
	4	Severe mental retardation, Cri du Chat Syndrome, Microcephaly.	Little speech, hypotonic, flat feet.	None.
	5	Mild mental retardation, Down's Syndrome.	Ventricular septal defect, little speech, frequent upper respiratory tract infections.	None.
	6	Severe mental retardation due to unknown causes, Microcephaly.	Hypertonia, slight right internal strabismus, little speech, severe frequent temper tantrums, short attention span.	Spectacles.

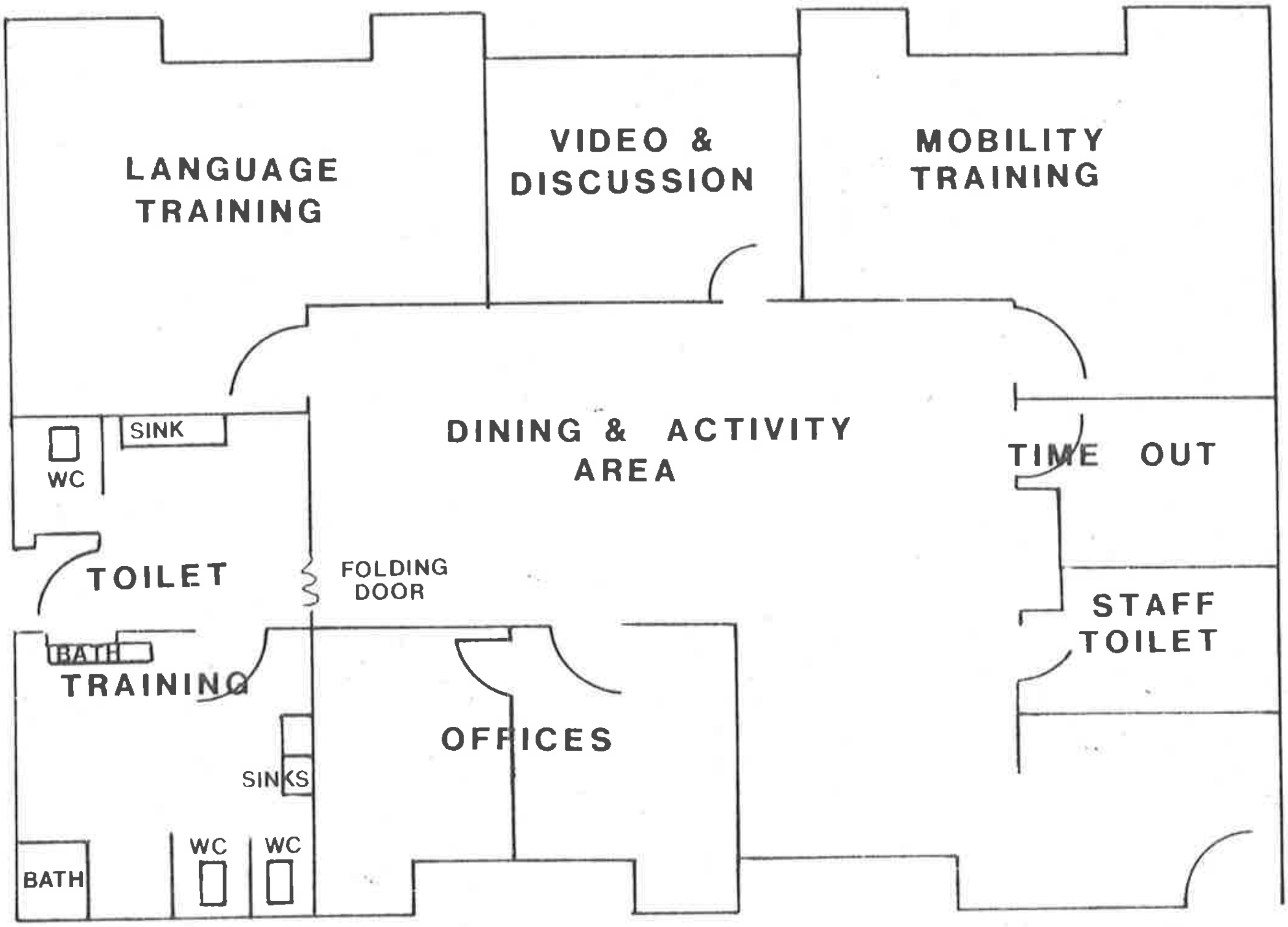
APPENDIX 7.1. cont.

TRAINING GROUP	CHILD	DIAGNOSIS & AETIOLOGY	ADDITIONAL PROBLEMS	ONGOING TREATMENT
	7	Severe mental retardation and possible cerebral ageneosis, Cultural-familial.	Self-abusive, stereotyped activity, no speech, mildly epileptic.	Carbamazepine.
	8	Moderate mental retardation, Down's Syndrome.	Cleft palate, congenital heart defect, squint.	None.
	9	Mild mental retardation with autistic features possibly due to rubella during pregnancy & birth trauma.	Possible moderate hearing loss, epileptic, some echolalic speech.	Carbamazepine, sodium valparate.
Non-contingent reinforcement	10	Severe mental retardation, Down's Syndrome.	Non-English speaking home, over-protected, partial hearing loss, overweight, no speech, abnormal EEG in left temporal region.	None.
	11	Severe mental retardation possibly due to intrauterine cerebral dysgenosis, Microcephaly & plageocephaly.	Hypotonic athetoid quadriplegia and ataxia, flexion deformities in 4th and 5th fingers, some visual impairment, no speech.	None.
	12	Moderate mental retardation due to unknown causes.	English and Russian speaking family, mild spastic diplegia, short attention span.	None.

APPENDIX 7.1. cont.

TRAINING GROUP	CHILD	DIAGNOSIS & AETIOLOGY	ADDITIONAL PROBLEMS	ONGOING TREATMENT
No reinforcement	13	Severe mental retardation possibly due to birth trauma, Cultural-familial.	Epileptic, left internal strabismus.	Carbamazepine.
	14	Mild mental retardation due to preclamptic toxaemia and calcified infarcated placenta.	Hyperactive, hypertonic, right internal strabismus, urinary frequency with no functional abnormality.	None
	15	Sever mental retardation, possibly due to physical and emotional deprivation, Microcephaly, failure to thrive.	Congenital cerebral dysgenesis, hypotonia, hyperactive, no speech.	Thioridazine.
	16	Severe to moderate mental retardation of unknown origin with additional haemophilus meningitis in infancy.	Hyperactive, behaviour problems, frequent temper tantrums, obese, family problems, frequent upper respiratory tract infections, hyperkinesia, some speech, mildly epileptic.	Carbamazepine, choledly
	17	Severe mental reatrdation due to chromosomal anomaly of unknown type.	Unsteady gait, flexion deformity of 4th and 5th fingers, mildly abnormal EEG, no speech, frequent upper respiratory tract infections.	None.
	18	Borderline to moderate mental retardation possibly due to prenatal and birth damage, possible irradiation during early pregnancy.	Some speech.	None

APPENDIX 7.2. Floor plan of the training unit used for the chaining programme in Study 2.



APPENDIX 7.3. Twenty t values testing differences in mean baseline scores across (a) contingency, and (b) reinforcement.

BASELINE MEASURES	(a) CONTINGENT VERSUS NON-CONTINGENT REINFORCEMENT t(10df)	(b) REINFORCEMENT VERSUS NO REINFORCEMENT t(16df)
Independence in pulling pants up	- 0.19	- 0.67
Independence in standing from toilet	0.57	- 0.25
Independence in sitting on toilet	1.58	- 0.22
Independence in pulling pants down	1.39	0.16
Independence in toilet approach	- 1.03	- 0.55
Percent toilet voidings/total toiletings	- 1.39	0.04
Time taken to void on toilet	- 0.69	- 1.14
Percent accidents/total voidings	1.31	- 0.11
Accident size	1.56	0.64
Percent self-initiated toiletings/ total toilet uses	- 0.22	- 0.44

Note: Differences between groups on these measures were not significant using the t-test.

APPENDIX 7.4. Individual subjects' improvement scores on ten toileting measures during training in Study 2.

Group	Subject	Independence in pulling pants up	Independence in standing from toilet	Independence in sitting on toilet	Independence in pulling pants down	Independence in toilet approach	Percent toilet voidings/total toiletings	Time taken to void in toilet	Percent accidents/total voidings	Accident size	Percent self-initiated toiletings/total toilet uses
1	1	0.0[a]	0.0[a]	0.0[a]	0.5	1.9	3.3[a]	0.0	32.8	0.3	12.2
	2	0.7	0.0[a]	0.0[a]	0.5	0.7	11.1	0.0[a]	14.1	3.0	59.2
	3	0.0[a]	0.2	0.0[a]	0.0[a]	0.3	10.2	-0.1	38.5	0.3	28.1
	4	3.7	0.0[a]	0.4	2.4	2.4	-5.9[a]	0.0[a]	-15.9[a]	-3.7[a]	62.3
	5	2.0	1.1	4.4	3.3	0.1	21.2	1.4	9.2	1.0	56.6
	6	1.3	0.7	4.3	1.8	3.4	62.7	12.3	53.7	1.8	78.3
2	7	1.5	0.3	0.0[a]	0.0[a]	0.2	84.6	3.5	42.2	0.6	35.1
	8	1.0	0.0[a]	0.0[a]	0.6	0.7	12.5	0.0[a]	31.0	-1.8	30.4
	9	0.7	0.7	0.0[a]	0.7	1.7	0.0[a]	3.3	32,1	2.0	60.0
	10	3.0	0.0[a]	0.0[a]	0.0[a]	3.0	33.3	0.1	59.7	3.8	100.0
	11	2.4	0.2	0.7	1.9	2.6	79.1	0.7	60.4	-0.2	74.7
	12	0.1	0.0[a]	0.0[a]	0.3	2.6	62.5	0.0[a]	61.7	-0.4	78.0
3	13	0.0[a]	1.2	0.0[a]	-1.8[a]	-5.0[a]	60.0	-2.7	28.3	0.9	12.1
	14	0.1	0.1	0.0[a]	0.0[a]	1.1	0.0[a]	0.0[a]	3.7	1.2	34.6
	15	0.6	0.2	0.0[a]	0.0[a]	1.6	0.0[a]	0.0[a]	36.5	2.7	75.0
	16	1.7	0.0[a]	1.5	1.5	4.5	27.3	-2.2[a]	35.4	1.7	47.4
	17	5.0	0.0[a]	3.7	-1.4	-0.8	55.0	0.0[a]	26.9	0.1	0.0
	18	3.2	0.4	0.7	2.3	1.1	20.9	-2.0	- 8.9	0.0	23.3

APPENDIX 8.1. Analysis of variance table for improvement in accidents as a percentage of all voidings.

SOURCE	MEAN SQUARE	F(df=1,16)
Beginning of training measure (as covariate)	15070.18	82.59***
Toilet training programme	205.79	1.13
Contingency of consequences	193.68	1.06
Residual error[a]	182.47	

[a] The interaction term was pooled with the error term, since it was not significantly different with $\alpha = .20$, and it was considered appropriate to increase the degrees of freedom for the error term in this way (Winer, 1971, p. 378-384).

*** P < .001

APPENDIX 8.2. Analysis of variance table for improvement in toilet voidings as a percentage of all toiletings.

SOURCE	MEAN SQUARE	F(df=1,16)
Beginning of training measure (as covariate)	11701.46	220.85***
Toilet training programme	681.77	12.87**
Contingency of consequences	28.52	0.54
Residual error[a]	52.98	

[a] The interaction term was pooled with the error term since it was not significantly different with $\alpha = .20$, and it was considered appropriate to increase the degrees of freedom for the error term in this way (Winer, 1971, p. 378-384).

** p < .01

*** p < .001

APPENDIX 8.3. Analysis of variance table for improvement in self-initiations as a percentage of all toilet voidings.

SOURCE	MEAN SQUARE	F(df=1,16)
Beginning of training measure (as covariate)	306.71	0.36
Toilet training programme (A)	5493.36	6.49*
Contingency of consequences (B)	647.08	0.77
A x B	1563.90	1.96
Residual error	798.00	

* p < .05

APPENDIX 9

TOILET TRAINING TO INDEPENDENCE FOR THE HANDICAPPED

A MANUAL FOR TRAINERS

pp. 1 - 136 following

Bettison, S. (1982). *Toilet training to independence for the handicapped: a manual for trainers*. Springfield, Ill: Thomas.

NOTE:

This publication is included in the print copy
of the thesis held in the University of Adelaide Library.

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