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1973

TREATMENT OF ENURESIS NOCTURNA BY
CONDITIONING METHODS: A FIELD EXPERIMENT

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CHAPTER I

INTRODUCTION

Enuresis nocturna has long been recognized as a benign, though all too frequent behavioral disorder of childhood. According to Glicklich (1951) attempts to treat enuresis date as early as 1550 B.C. Today a number of therapeutic procedures are available in the treatment of bedwetting. These are: suggestion; medication primarily by strong stimulants; exercises designed to enlarge bladder volume; psychotherapy; and conditioning of an avoidance response. As shall be seen in the following review, the success rate and claims for each of these methods are subject to many contaminating variables and conflicting reports which only corroborate the impression that enuresis remains a very persistent problem.

Nocturnal enuresis is operationally defined by Lovibond (1964) as bedwetting after chronological age of three years, with a frequency of wetting of at least three times per week. At three years of age, approximately 20 per cent of all children are still wetting the bed. By age ten years, the incidence of enuresis has decreased to approximately 5 per cent. Enuresis occurs more frequently in males than females (Lovibond, 1964).

According to Lovibond (1964), Mowrer (1938), and Crosby (1950) the conditioning method is the treatment of choice in the majority of enuretic children. Mowrer and Mowrer (1938) are credited by Lovibond for the development of the first practical conditioning device. Conditioning is achieved in the following manner: When the patient wets, the urine shorts an electric current whichaactivates a relay causing a very loud bell to ring. The bell serves as an aversive stimulus which, besides being very unpleasant, interrupts sleep. To avoid the bell the patient gradually learns to inhibit wetting or to arouse in time to go to the bathroom to void. There is disagreement as to which conditiioning paradigm most closely fits the conditioning treatment procedure developed by Mowrer and Mowrer (1938). The treatment procedure appears to have most of the characteristics of Konorski's Type II Variety IV conditioned reflax (Konorski, 1948). An example of this form of reflex training may be seen in the conditioning of a dog's foreleg. In the initial stage of conditioning, passive flexion of the dog's foreleg is followed by electric shock (unconditioned stimulus) to the limb. After several trials the dog strongly resists further attempts to flex the leg. In the final stage of training the dog not only resists but produces an antagonistic response of leg extension. The conditioned stimulus in this paradigm is provided by the kinesthetic stimuli at the moment of passive flexion and extension is the conditioned reflex to be learned which avoids the unconditioned stimulus. Lovibond (1964) and Mowrer (1938) agree that the loud bell serves as the unconditioned stimulus. The distended and contracting bladder is viewed as the conditioned stimulus and the response to be acquired is awakening and sphincter contraction.

Review of Literature

In 1938 Mowrer and Mowrer first reported the successfulltreatment of enuresis by a conditioning method. However, the perplexing issue surrounding the findings of Mowrer and Mowrer is that more than thirty-three years later the treatment of enuretics is still subject to controversy and conditioning procedures have received limited refinement. Recent research with direct conditioning methods report success rates ranging from 65 per cent to 100 per cent (Mowrer, 1939; Davidson and Douglass, 1950; Sieger, 1952; Geppert, 1953; Baller and Schalock, 1956; Behrle et al., 1956; Wickes, 1958; Gillison and Skinner, 1958; and Freyman, 1959). All these investigators indicate that after arrest of symptoms there was a high relapse rate varying from 13 per cent to 48 per cent.

The dependent variables most often employed to measure acquisition of the conditioned response were:

(1) the size of the wet spot, i.e. the diameter of the wet spot measured in inches; (2) the number of trials (nights) to extinction; (3) the number of times the S wets the bed during the evening sleep period. The diameter of the wet spot was reported to have noticeably decreased with attainment of acquisition, and the latency time became greater with the development of the conditioned response (Lovibond, 1964). Additionally, the Ss began to wet the bed less frequently in a one night sleep period as well as over the entire time the Ss were in treatment.

The high relapse rate may be interpreted as a result of the schedule of reinforcements employed for conditioning enuretic Ss. A study by Hulse (1962) illuminates some of the factors pertinent to the remission of symptoms during the extinction period of learned conditioned behavior. Hulse trained rats to run a runway, and he reinforced one group 46 per cent of the learning trials, and gave another group reinforcement 100 per cent during the training trials. He found that the continuously reinforced group ran and learned faster than the partially or intermittently reinforced group. However, during extinction (omission of reinforcement for learned behavior) the partially reinforced group maintained the learned behavior for many more trials than the continuously reinforced group. Another study by Humphreys (1939) revealed that random reinforcement of conditioned eyelid reactions showed higher resistance to extinction of the acquired response than did reinforcement on every trial. The Humphreys or intermittent reinforcement effect (IRE) has been shown to have application in many different areas of learning.

Lovibond (1964) reports that Notterman, Schoenfeld and Bersh (1952) successfully demonstrated the IRE with classical conditioning of heart rate; other investigators have been Grant, Hake and Hornseth (1951) on human verbal learning; Jenkins, McFann and Clayton (1950) on instrumental pecking in pigeons; Jenkins and Rigby (1950) on bar pressing by rats; and Jones (1953) on escape learning by rats.

One hypothesis offered in support of the IRE is: the greater the ratio or interval of unreinforced responses occurring in the acquisition schedule, the more slowly extinction proceeds. The reason given is that discrimination between acquisition and extinction is more difficult for the partially reinforced group, therefore, the more trials for the extinction criteria to be achieved. D'Amato and Gumenick (1960) state that acquisition of learned behavior is attained with the least number of trials when reinforcement is continuous and extinction (absence of reinforcement) of learned behavior is most rapid under these conditions. However, when learned behavior is acquired through intermittent reinforcement the extinction period is of a much longer duration.

In accord with IRE findings, research with enuretic Ss has been attempted (Lovibond, 1964) although the results did not show similar success as achieved in other areas of learning. Some of the factors considered as possible contaminants in conditioning enuretics are: the high arousal threshold enuretic Ss have during deep sleep; the chronological age of the Ss; and primarily the methodology of intermittent reinforcement as used by investigators.

Enuresis nocturna is very often categorized as one of the sleep disorders along with somnambulism and nightmares. Although enuresis is not always accompanied by other sleep disorders, Finley (1971) has shown that there is a significant number of enuretic Ss that do show an unusually high arousal threshold while in deep sleep. The results of Finley's study with enuretics and non-enuretics show not only a significant difference between arousal threshold, but also between chronological age. The Ss were divided into three age groups (five years old, ten years old, and fifteen years old). The enuretics were significantly more difficult to arouse than the non-enuretics ($p < 0.01$). Additionally, the study revealed that chronological age is a related factor with depth of sleep at the moment of enuresis. Finley found that as age increases, the depth of sleep in which enuresis occurs becomes progressively lighter. Therefore, many studies which have not demonstrated success with alarm arousing stimuli in conditioning enuretics can possibly be accounted for by the results of Finley's research. That is, because of the enuretic's high arousal threshold, a loud bell is needed to ensure waking him. Moreover, as proposed by Finley, a bright light being turned on following the enuretic episode may further help in arousing the enuretic.

However, the primary factor relevant to the relapse rate when attempts were made to utilize intermittent reinforcement is the schedule of reinforcement. Lovibond and other investigators have long been aware of the extinction phenomena comparing continuous with intermittent reinforcement. The method employed in the past to establish an IRE was by random selection, turning the equipment off on specific nights. The problem resulting from that procedure was that enuretics may urinate as many as five times a night during sleep (Finley, 1971). Therefore the effect of prior reinforcement might be extinguished in one evening of sleep.

Statement of Problem and Purpose

Although conditioning is often viewed as the most efficacious means of treating enuresis, successful treatment often is followed by relapse. According to Lovibond (1964) relapse rates range as high as 50 per cent. It is probable that such treatment failures occur for a number of reasons. Foremost are the conditioning parameters per se. A relapse may be viewed in learning theory terms as extincion of the acquired response. According to learning theory and research reviewed in this study, intermittent reinforcement as compared to continuous reinforcement should result in a lower rate of extinction of the acquired response (Hulse, 1962).

Finley's study (1971) illustrates the importance of employing an alarm bell capable of arousing the enuretic Ss. Moreover, his findings indicate why it is necessary to choose Ss within a specified age range, as well as equipment which can be operated on an intermittent schedule of reinforcement during sleep without being turned off.

The major purpose of the investigation was to determine if intermittent reinforcement resulted in a lower relapse rate than when continuous reinforcement was used. It was anticipated that the study would have practical implications in the treatment of bedwetting. The implications are: a greater success in the treatment of enuretics, decrease in the relapse rate, and stricter control of the treatment process.

Statement of the Hypotheses

1. Intermittent versus continuous reinforcement:
   - (a) Subjects continuously reinforced will attain criterion for acquisition in significantly fewer trials than subjects in the intermittent group.
   - (b) Subjects continuously reinforced will extinguish the acquired behavior significantly more often than the intermittent group.

(c) Subjects continuously and intermittently reinforced will attain criterion in significantly fewer trials than zero reinforcement group.

2. As number of nights of treatment increases the latency from time in bed to the enuretic episode should increase.

3. As number of nights of treatment increases the diameter of the wet spot should decrease.

CHAPTER II

METHOD

Subjects

Thirty male Ss between the ages of six to eight years served in the study. The Ss were selected from applications received at the Children's Medical Center in response to a letter published in the Tulsa Public Schools requesting enuretic Ss as volunteers in a treatment research project. (See Appendix E.) Subjects who met the following criteria were selected for participation: (1) they were students in the Tulsa Public School System and achieving at grade level; (2) they resided in a single-family dwelling and slept alone in a bedroom separate from their parents; (3) they met the operational definition of bedwetter (enuresis three or more times a week); and (4) they were essential enuretics (since birth).

Design

The design included three experimental groups: (1) continuous (100 per cent) reinforcement; (2) intermittent (70 per cent) reinforcement; and (3) control (0 per cent), no reinforcement. The dependent variables were: (1) the number of trials (wettings) to reach acquisition; (2) the number of wet nights to reach acquisition; (3) the size of the wet spot; (4) latency from bedtime to onset of first enuretic episode; (5) proportion of Ss reaching acquisition; and (6) the number of Ss showing extinction of acquisition in each group.

Task and Apparatus

The Ss task was simply to go to sleep in their own bed, sleeping on the bed wetting pad. However, the parent of each S had a more involved task to perform. Instructions to the parents are presented in Appendix A.

The apparatus consisted of: an alarm bell (Alarm Device Manufacturing Company Model AC 10-110) which has a measured decibel (db) level of 105 db at nine feet on A scale (ref: 0.0002 dynes/cm^2) measured by a Bruel and Kjaer precision level meter Type 2203; a rubber pad 3 mm thick and 50 cm long by 57 cm wide. On the surface of the pad, embedded in General Electric Silicon Seal rubber, was stainless steel wire mesh in 5mm wide strips. Each strip was separated by 5mm. The strips were arranged to provide a grid which could be shorted together by moisture on the pad. The basic treatment instrument operates in a manner similar to conventional Mowrer conditioning treatment devices. This consists of a pad which, when wetted with the electrolytic urine, closes a circuit (6 volts d.c.) causing a loud (105 db) bell to ring, accompanied by a bright (General Electric 75 watt) light over the S's bed. The schematic for the Programmed Enuresis Treatment (PET) device is shown in Appendix B. Also attached to the PET is a small bell (Edwards Dixie Bell number 720) which is installed in the parents' bedroom (decibel level equivalent to 78 db at three feet on A scale (ref: 0.0002 dynes/cm^2). Estimated room noise is approximately 40 db on A scale. Other apparatus included a home clock; and scoring sheet (see Appendix C) on which the parent recorded the time and size of the wet spot. In addition, the PET had a counter which counted how many wettings occurred within a night. The PET could count up to twelve wettings per night. The counting mechanism of the PET allowed the experimenter to check for accuracy of the parent's nightly reports of frequency of wettings per night.

Procedure

The Ss were assigned by random selection from a table of random numbers to the three experimental groups with ten Ss in each group. Schedules of reinforcement for the intermittent reinforcement (IR) group are shown in Appendix D. Note that all Ss in the IR group received continuous reinforcement for the first seven trials and then 70 per cent reinforcement in blocks of ten by random selection. The schedule of reinforcement for the IR group complied with optimal learning theory principles for attainment of acquisition (Lovibond, 1964).

Subsequent to the placement of the equipment in the home, each parent received instructions for operating the equipment. None of the parents were told prior to or during the experiment to what group their child was assigned.

The operational criterion for acquisition was seven consecutive dry nights. During the extinction phase, the S continued to sleep on the pad so as to maximize learning conditions. The treatment device differs from conventional devices in that any ratio of nonreinforced trials (wettings) may be programmed into the treatment instrument.* Upon wetting in a nonreinforced trial, a twenty minute timer is activated which, at the end of twenty minutes, activates the 78 db bell in the parent's room.

It was possible that some of the Ss would never reach acquisition; therefore, six weeks had been set as the maximum term of treatment during the acquisition phase. Subjects who had attained acquisition were followed for a period of three months from time of acquisition to determine if they experienced a relapse. If a S had not relapsed during the three month period, the S was operationally defined as cured.

The experiment was performed at the home of the S and therefore can be classified as a "field experiment."

*Patent pending

Data Analysis

The dependent variables measured were: (1) the acquisition parameters: (a) the number of nights treated analyzed by a single factor independent sample Analysis of Variance (ANOVA); (b) the number of wet nights per week analyzed by a two-way Analysis of Variance (Groups X Weeks); (c) the number of wettings per week (analyzed on an individual basis by Pearson _r_ correlation and then a transformation of the correlations to Fisher _z_ scores, followed by a zero Mu _t_ test for each treatment group; then a single factor independent sample ANOVA of the Fisher _z_ scores; and a two-way ANOVA (Groups X Weeks)); (d) the number of trials wet until termination of treatment analyzed by a single factor independent sample ANOVA; and the number of reinforced trials (CR group versus IR group) analyzed by a _t_ test for independent samples; (e) the latency in minutes from time in bed to the onset of the first wetting per night, and the size of the wet spot measured in inches, both analyzed by a Pearson _r_ correlation and then a transformation of the correlations to Fisher _z_ scores, followed by a zero Mu _t_ test for each treatment group, then a single factor independent sample ANOVA of the Fisher _z_ scores. Newman Keuls multiple comparison tests were computed on those variables which were found to be significant after the single factor independent sample ANOVA was calculated. (2) The success and relapse rates for the IR group were analyzed by a binomial test with the expected value determined by taking the results of the CR group and comparing them with the results of the IR group.

CHAPTER III

RESULTS

The following data will be analyzed in this section: (1) Acquisition parameters: (a) the number of nights treated, the number of wet nights per week, and the number of wettings per week; (b) the number of trials (wettings) until termination of treatment; (c) the latency in minutes to the onset of the first wetting per night and the size of the wet spot measured in inches. (2) The success rate for the continuous and intermittent reinforcement groups. (3) The relapse rate over a three month follow-up period for the Ss who achieved acquisition.

Acquisition Parameters

The mean number of wettings (trials) per week during the six week acquisition phase are shown in Figure 1 for the three treatment groups. The results were analyzed by a two way ANOVA with repeated measure on one factor (weeks).[1] There was a significant difference among the treatment groups in regard to the

[1]The ANOVA, as all the other statistical analyses, was computed on an Olivetti Computer Programmer 101.

mean number of wettings as indicated in Table 1. Additionally,

TABLE 1

SUMMARY OF ANALYSIS OF VARIANCE FOR NUMBER OF WETTINGS PER WEEK FOR THE THREE TREATMENT GROUPS

Source	df	MS	F	p
Between subjects				
A (Groups)	2	489.68	18.84	.01
A (n - 1)	27	25.99		
Within subjects				
B (weeks)	5	101.92	16.39	.01
AB	10	34.62	5.56	.01
A (n - 1)(B - 1)	135	6.21		

there was a significant decrease in the overall number of wettings across the six weeks of treatment as shown by a conservative test.[2] The treatment Groups by Week interaction was found to be statistically significant as shown by the F test (conservative test).

Figure 1 shows that the continuous and intermittent reinforcement groups experienced a reduction in the mean number of wettings across the six week period. The number of wettings per week across the six weeks was calculated for each treatment group by a trend analysis procedure. A Pearson r coefficient was determined for each S with the correlation then transformed to a Fisher z score.

[2]Degrees of freedom adjusted according to Greenhouse and Geisser (1959) to control for possible absence of homogeneity of covariance found in repeated measure analyses.

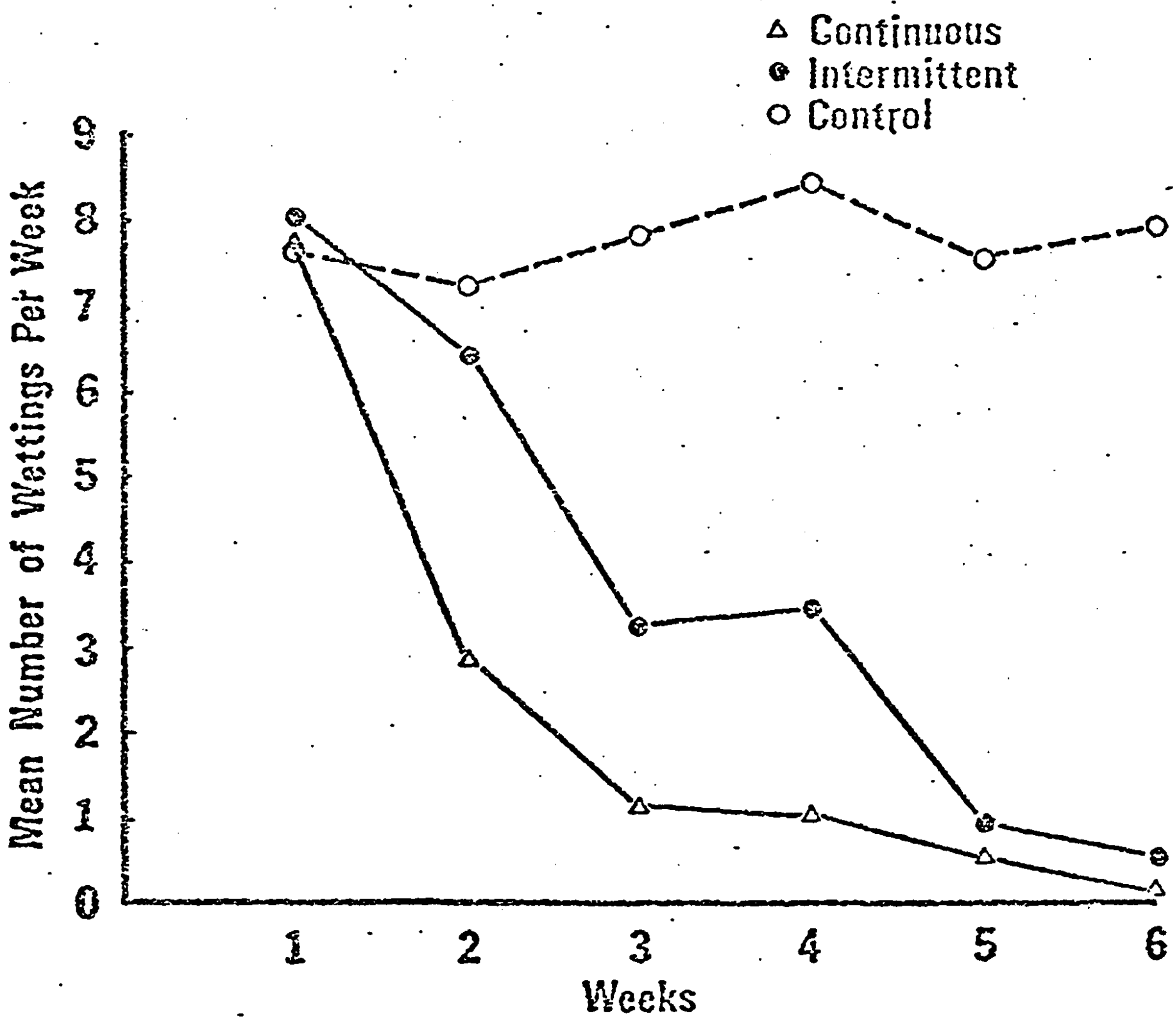

Figure 1. Mean number of wettings per week for each group.

The Fisher z scores were then analyzed by a zero Mu t test for each treatment group. The mean correlation of wettings per week across the six weeks was -0.72 (t = 13.71, df = 9, p 0.005) and -0.79 (t = 13.09, df = 9, p 0.005) for continuous and intermittent treatment groups respectively. The control treatment group correlation for the six weeks was equal to -0.05 (t = -0.18, df = 9, N.S.). These results may be interpreted as indicating that the continuous and intermittent treatment conditions exhibit a significant learning curve, while the control condition showed no improvement. The Fisher z scores were submitted to a single factor independent sample ANOVA for the treatment groups in order to establish if the trend for the three groups differed significantly from one another. The F ratio for Groups was found to be statistically significant as indicated in Table 2. A Newman Keuls multiple comparison test showed that

TABLE 2

SUMMARY OF ANALYSIS OF VARIANCE OF
FISHER Z SCORES FOR NUMBER OF WETTINGS PER WEEK

Source	df	MS	F	p
A (Groups)	2	3.11	12.53	0.01
A (n - 1)	27	0.25		

continuous and intermittent treatment groups did not differ significantly in acquisition curves although both treatment groups were significantly different from the control condition ($p < 0.01$ for the comparisons).

The mean number of wet nights per week are shown in Figure 2. The results were analyzed by a two way ANOVA with repeated measures on one factor (weeks). There was a significant difference among the three groups with regard to the mean number of wet nights as shown in Table 3.

TABLE 3

SUMMARY OF ANALYSIS OF VARIANCE FOR NUMBER OF WET NIGHTS PER WEEK FOR THE THREE TREATMENT GROUPS

Source	df	MS	F	p
Between Subjects				
A (Groups)	2	272.50	34.13	.01
A (n - 1)	27	7.98		
Within Subjects				
B (Weeks)	5	48.81	30.66	.01
AB	10	11.11	6.97	.05
A (n - 1)(B - 1)	135	1.59		

Analysis of the main effect for weeks indicated that the number of wet nights significantly decreased across the six week period.

Statistical significance was also attained for the treatment Groups by Week interaction, again using the conservative F test procedure. Figure 2 shows the decrease of wet nights per week across the six weeks for both the continuous and intermittent groups, while the non-reinforced

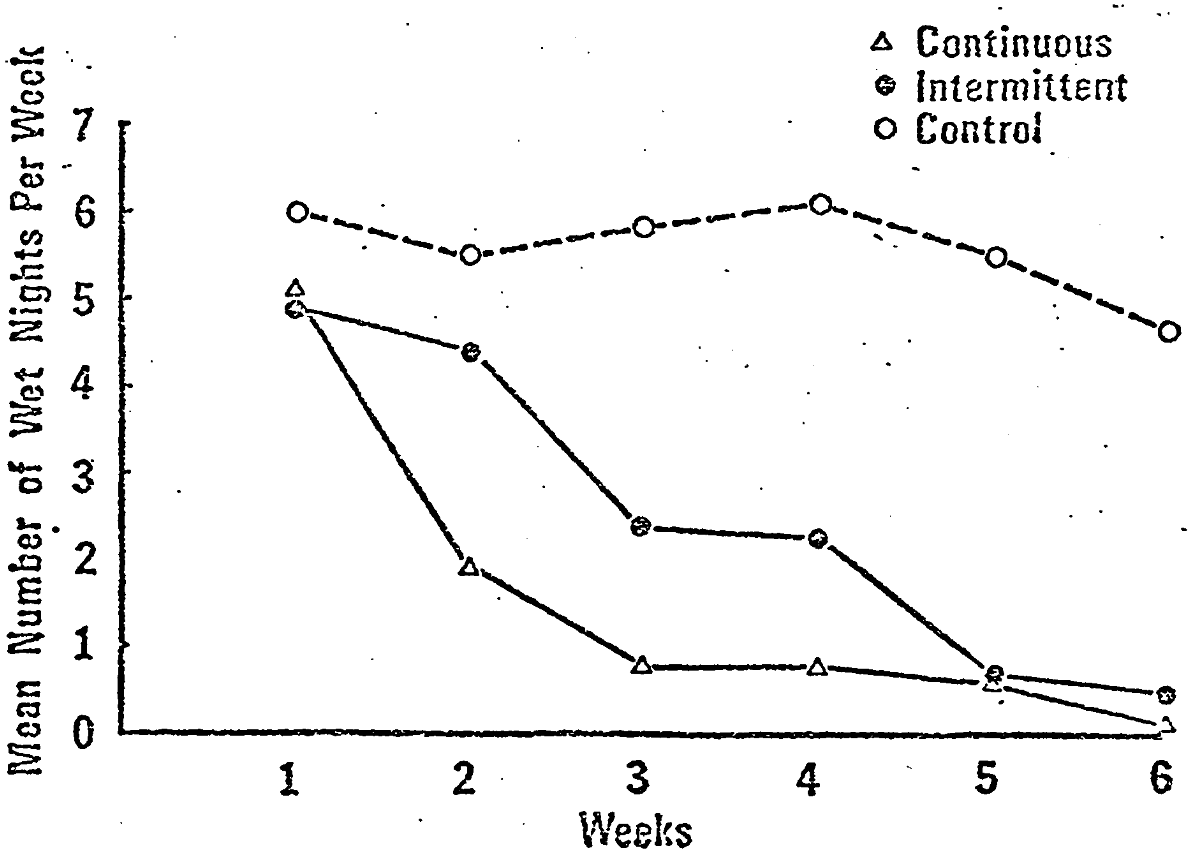

Figure 2. Mean number of wet nights per week for each group.

control group persisted across the six weeks with a high level of wet nights. A correlation of wet nights per week was calculated for each S and a Pearson r coefficient obtained and then transformed to Fisher z scores. The Fisher z scores were then submitted to a zero Mu t test for the three groups which revealed significant trends across the six weeks for the continuous and intermittent groups with mean correlation of -0.77 (t = -13.68, df = 9, $p < .0005$) and -0.81 (t = -8.89, df = 9, $p < .0005$) respectively. The control group mean correlation was -0.24 (t = -0.96, df = 9, N.S.). The Fisher z scores were submitted to a single factor independent sample ANOVA for the three treatment groups and statistical significance was obtained as shown in Table 4. These results indicate that

TABLE 4

SUMMARY OF ANALYSIS OF VARIANCE OF FISHER Z SCORES FOR NUMBER OF WET NIGHTS PER WEEK FOR THE THREE TREATMENT GROUPS

Source	df	MS	F	p
A (Groups)	2	2.34	8.09	.01
A (n - 1)	27	0.29		

the trends across the three groups differ significantly from one another. A Newman Keuls multiple comparison test showed that the trends for both the continuous and intermittent groups differ significantly from the control group

($p < .01$ for both comparisons), but were not significant from each other in terms of the acquisition learning curve.

The number of nights treated for the three treatment groups is shown in Figure 3. The data was analyzed by a single factor independent sample ANOVA to establish whether the trends for the treatment groups were significantly different from one another. The ANOVA revealed statistical significance as indicated in Table 5 across

TABLE 5

SUMMARY OF ANALYSIS OF VARIANCE FOR NUMBER OF NIGHTS TREATED

Source	df	MS	F	P
A (Groups)	2	1055.03	15.27	.01
A (n - 1)	27	69.07		

the three treatment groups. The results were then submitted to a Newman Keuls multiple comparison test. The Newman Keuls test indicated significant difference between the intermittent and continuous groups $p < .05$, between the intermittent and control groups $p < .01$, for the acquisition learning curve.

The number of trials wet until acquisition of treatment (six weeks) is shown in Figure 4. The data was submitted to a single factor independent sample ANOVA to

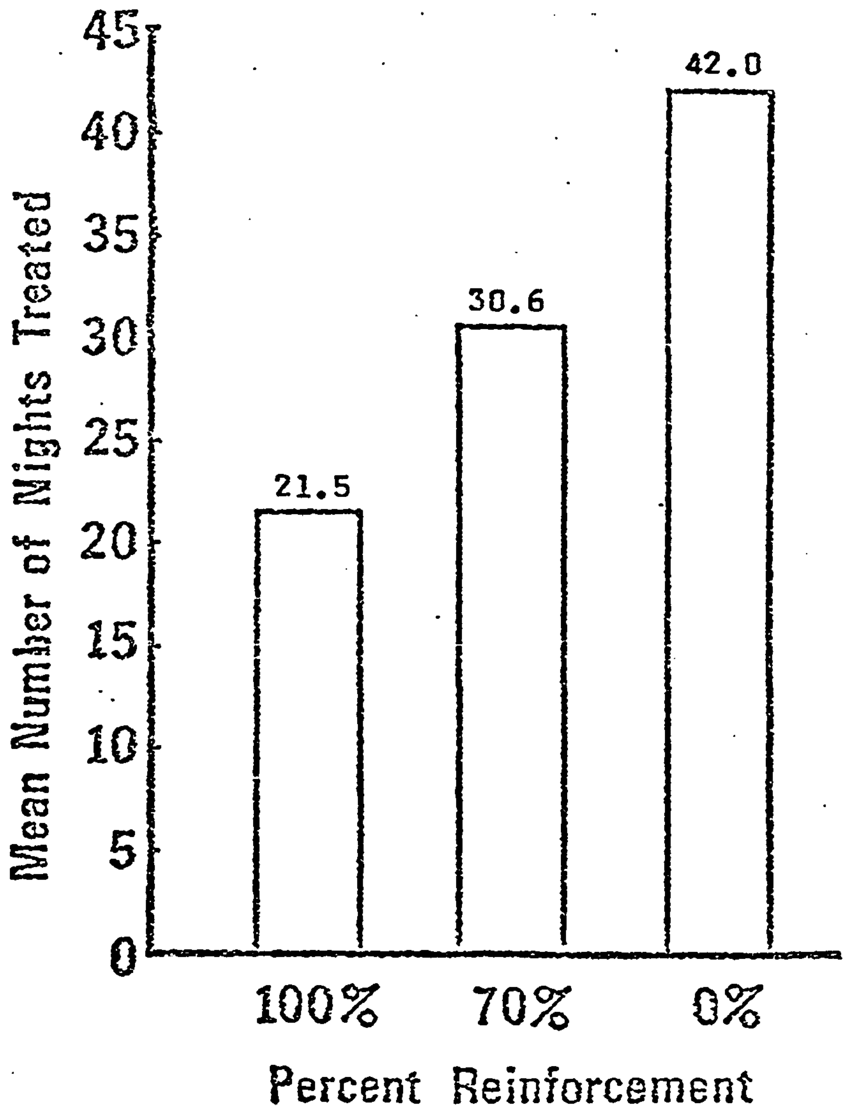

Figure 3. Mean number of nights treated for each group.

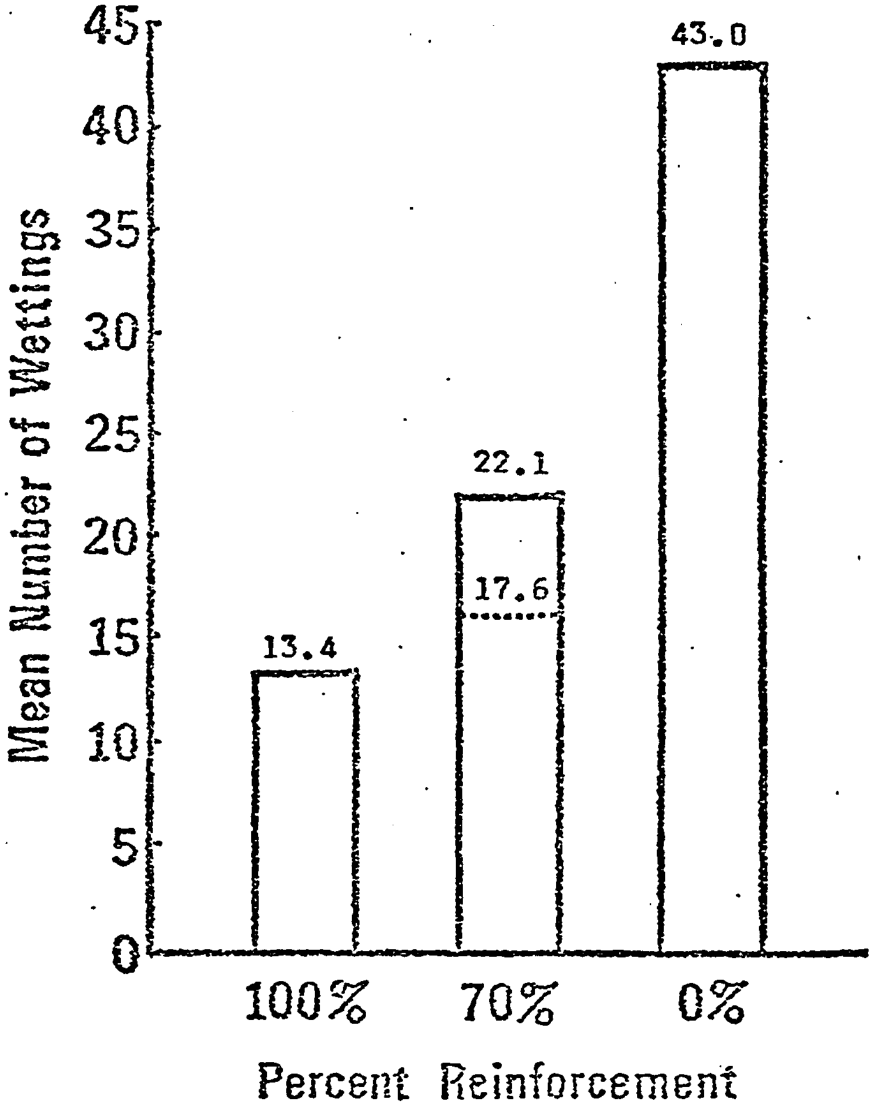

Figure 4. Mean number of wettings for each group. The dotted line indicates the mean number of reinforced trials for the intermittent group.

determine if the trends for the three treatment groups were statistically significant from each other. Statistical significance was shown by the ANOVA across the groups as indicated in Table 6. The data was then examined by a

TABLE 6

SUMMARY OF ANALYSIS OF VARIANCE FOR NUMBER OF WET TRIALS UNTIL ACQUISITION OR SIX WEEKS

Source	df	MS	F	P
A (Groups)	2	2314.43	13.67	.01
A (n - 1)	27	169.23		

Newman Keuls multiple comparison test. The Newman Keuls test showed a significant difference for the comparison of the control groups with both the intermittent and continuous groups $p < .01$, although the intermittent and continuous groups do not differ significantly.

The number of alarm bells (105 decibels) for both the CR and IR groups was submitted to a t test for the independent samples. The results revealed no significant difference between the two groups ($t = 1.09$, $df = 18$, N.S.). These results are shown in Figure 4, in which the dash line on the IR histogram indicates the actual number of alarm bells (UCS) since the IR group received reinforcement on 70 per cent of the trials.

The latency in minutes to the first wetting per night was submitted on an individual basis to a Pearson r coefficient correlation procedure with the correlations then transformed to a Fisher z score. The Fisher z scores were then analyzed by a zero Mu t test for each of the three treatment groups. The mean correlation of latency to the onset of the first enuretic episode per night was -0.48 ($t = -1.51$, $df = 9$, N.S.) and -0.03 ($t = -0.49$, $df = 9$, N.S.) for the CR and NR groups respectively. However, the IR group showed a significant learning curve of latency to the first wetting per night with a correlation of 0.18 ($t = 1.88$, $df = 9$, $p < 0.05$).

The Fisher z scores were then submitted to a single factor independent sample ANOVA to determine if the learning curves were significantly different for the three treatment groups. The ANOVA did not reveal statistical significance as shown in Table 7.

TABLE 7

SUMMARY OF ANALYSIS OF VARIANCE OF FISHER Z SCORES FOR LATENCY IN MINUTES TO ONSET OF FIRST ENURETIC EPISODE PER NIGHT

Source	df	MS	F	p
A (Groups)	2	1.17	3.04	NS
A (n - 1)	27	0.38		

The size of the wet spot measured in inches was correlated with number of trials by a Pearson *r* correlation and then transformed to Fisher *z* scores. The Fisher *z* scores were then submitted to a zero Mu *t* test for investigation of the learning curve trend analysis for each treatment group. The mean correlation for size of wet spot with number of trials was -0.32 ($t = -2.81$, $df = 9$, $p < 0.025$) and 0.13 ($t = 2.13$, $df = 9$, $p < 0.05$) for the IR and NR groups respectively. The mean correlation for the CR group was not significant, 0.34 ($t = 1.11$, $df = 9$, N.S.). These results may be interpreted as indicating a size decrease in the size of the wet spot, thus indicating a significant acquisition curve for the IR group. A significant increase in size of wet spot with number of trials was found for the NR group. A non-significant trend for the CR group occurred. The Fisher *z* scores were then analyzed by a single factor indpendent sample ANOVA to establish whether the learning curves differed significantly from each other. The ANOVA revealed no statistical significance as shown in Table 8. A repeated measures *t* test was

TABLE 8

SUMMARY OF ANALYSIS OF VARIANCE FOR SIZE OF WET SPOT WITH NUMBER OF TRIALS

Source	df	MS	F	p
A (Groups)	2	1.22	3.09	NS
A (n - 1)	27	0.39		

performed on size of the wet spot for the IR group only, comparing size of the wet spot for reinforced and non-reinforced trials. The results showed a significant difference ($t = 3.12$, $df = 9$), $p < 0.01$) with the mean size of the wet spot for reinforced trials equal to 7.26 inches and for non-reinforced trials equal to 13.05 inches.

Success Rate

The CR group had nine out of ten Ss achieve criterion of dryness (seven consecutive nights dry) before the forty-second night of treatment (six weeks). Eight of the ten Ss in the IR group achieved criterion, while none of the ten Ss in the NR group attained acquisition within the six week period. A Binomial test analysis showed the success rates for the continuous (90 per cent) and intermittent (80 per cent) groups did not differ with statistical significance ($p < 0.19$).

Relapse Rate

An examination of relapse incidence showed four of the nine Ss who had achieved criterion in the CR group had relapsed to the operational definition of bed-wetting (three or more nights per week) during the three month follow-up period. Of the eight Ss in the IR group only one relapsed within the three month follow-up period.. A binomial test analysis showed the relapse rates for the two groups differed significantly ($p < 0.05$).

CHAPTER IV

DISCUSSION

The following will be discussed in this chapter: (1) acquisition parameters, and attainment of criteria; (2) success rate; and (3) relapse rates.

Acquisition Parameters and Attainment of Criteria

The results clearly show the effectiveness of conditioning treatment for enuresis nocturna. Of the twenty Ss in both the CR and IR groups combined, seventeen Ss achieved criterion, while none of the Ss in the NR group attained criterion. The mean number of wettings during treatment decreased significantly across the six week period for both the CR and IR groups, with no significant reduction of wettings having occurred for the NR group. A distinction must be made for the number of wettings during treatment and number of nights wet. The maximum number of nights wet during any one of the six weeks of treatment would be seven; however, the maximum number of wettings per week was undetermined and possibly greater than seven wettings per week, since a S could have multiple wettings per night. Lovibond (1964) reported the multiple wetting factor and described the problem it presented when a schedule of intermittent reinforcement was applied in treatment (possible extinction of acquired response in a single night by multiple wettings). This study confirms Finley's (1971) finding that Ss do have more than one wetting in a single night. Both in his study and in the recent investigation, the maximum number of wettings was five per night. The use of intermittent reinforcement was not in this case detrimental to conditioning procedures because rather than removing or turning off the conditioning apparatus for a particular night to effect partial reinforcement, as did Lovibond (1964), the PET was programmed to deliver intermittent reinforcement at any randomly chosen wetting (trial). The results for wetting per night and number of nights wet revealed not only the efficacy of conditioning treatment, but additionally the viability of intermittent reinforcement in the treatment of enuresis nocturna. Subjects in the CR and IR groups differed significantly in acquisition of criterion from the NR group. However, both groups did differ significantly from the NR group in the acquisition of criterion. The number of nights treated revealed that the CR and IR groups differed significantly from the NR group as well as from each other. These results would appear to support the hypothesis that the CR group would attain acquisition sooner than the IR group; however, when the CR and IR groups were compared as to actual number of trials (with or without reinforcement) no significant differences were found. Therefore, it has been demonstrated that continuous and intermittent reinforcement do not differ significantly as to capability of effecting acquisition in terms of trials.

The results for the dependent variable, latency in minutes to the onset of the first enuretic episode per night, revealed no significant learning trend for either the CR or NR groups. The latency variable was expected to show an increase in time to the onset of enuresis with an increase in number of trials during treatment. Subjects receiving reinforcement were expected to learn to avoid the aversive stimulus occurring on reinforced trials and thereby increase the latency in minutes to onset of the first enuretic episode, eventually extending the latency through the entire evening sleep period to morning. Although the CR group did not demonstrate a significant increase in latency, the IR group did, again suggesting the advantage of intermittent reinfocement. Another dependent variable of considerable importance according to Lovibond (1964) was the size of the wet spot measured in inches and correlated with number of trials. The anticipated result for the wet spot variable was that the size of the wet spot would decrease with an increase in number of trials, thus reflecting a significant learning trend.

The size of the wet spot is an indicator of the S's response to treatment (Lovibond, 1964). One possible rationale for decrease in wet spot with trials is that inhibition of the sphincter muscle (parasympathetic innervation) is acquired by (sympathetic) arousal to the UCS (antagonistic responses). Therefore, in order to avoid the UCS and maintain sleep the S learns to inhibit the sphincter muscles upon stimulation of the distending bladder (CS), hence avoiding the UCS and as a result reducing the size of the wet spot until dry. The IR group did show a significant decrease in the size of the wet spot, over trials; however, the CR group showed no significant learning trend and the NR group actually became significantly worse, with the size of the wet spot increasing across trials. When the IR group was examined as to size of wet spot for reinforced and non-reinforced trials, a significant difference was found. On non-reinforced trials the size of wet spot was much greater than when reinforcement occurred, thereby demonstrating the effectiveness of the UCS as an arousal stimulus and its ability to effect conditioning to bladder tension and sphincter inhibition. These findings may be interpreted as indicating that attainment of acquisition for the three treatment groups does differ significantly. The NR group responded to treatment as expected; however, the CR group did not. The IR group showed a learning trend which the CR group did not demonstrate. A possible reason for the absence of a learning trend in the CR group may be that, rather than a gradual development of acquisition as shown for the IR group, the CR group acquired the learned response in a sudden all-or-none fashion.

Success Rate

The acquisition parameters revealed how the treatment groups approached criterion, whereas the success rate only considered whether or not a S attained acquisition. Nine of ten Ss in the CR group were treated successfully; i.e., achieved acquisition, while eight of ten Ss in the IR group attained criterion within the six weeks of treatment. However, analysis of these results did not reveal statistical significance for the success rate variable between the CR and IR groups.

Relapse Rate

The Ss who attained acquisition were followed for three months post treatment to determine if they had experienced a relapse. Relapse, viewed in learning theory terms as extinction of the acquired response, was operationally defined as bedwetting three or more nights per week. The results showed that four of the nine Ss in the CR group had relapsed, while only one of the eight Ss in the IR group had resumed wetting. The results were found to be significant and in support of the major hypothesis, that intermittent reinforcement would yield a lower relapse rate than would continuous reinforcement. The results for relapse rate in the IR group may be interpreted as confirmation of the resistance to extinction found by use of intermittent reinforcement which Hulse (1962), Humphreys (1939), D'Amato and Gumenick (1960), and Lovibond (1964) purported as essential to the extinction phenomena related to conditioning therapy. When a S attained acquisition the PET was removed from his home; however, to retain a minimum amount of external stimuli similar to treatment, all Ss continued to sleep on the bedwetting pad for the three month follow-up period. Subjects in both the CR and IR groups received identical treatment during the extinction phase; however, the high relapse rate for the CR group may possible be explained as a function of the ability to discriminate between acquisition and extinction phases of treatment. The IR group, because of the partial reinforcement schedule during acquisition, were not as capable of discriminating between the acquisition and extinction phase (Mowrer, 1960). Mowrer (1960) suggests that during the acquisition phase intermittent reinforcement has by definition a built-in extinction phase of treatment (a percentage of non-reinforced trials). Therefore, when true extinction (no reinforcement) commences the intermittently reinforced S has already experienced during acquisition non-reinforcement, and is more easily capable of maintaining the acquired behavior through extinction with less relapse than a continuously reinforced S who has not experienced non-reinforcements. The explanation supports a discrimination hypothesis in that intermittently reinforced Ss are unable to detect a difference between the acquisition and extinction phase, while continuously reinforced Ss detect the change on the very first wetting during extinction. It was found that Ss in both groups did have an occasional wetting; however, only five of the seventeen Ss experienced a relapse of three or more wet nights per week. Of the twelve Ss remaining dry after the three month follow-up period, seven Ss were from the IR group and five Ss were from the CR group.

What is evident from this research with enuretic Ss is that the speed with which acquisition is achieved is not as important as the stability of learning, and that intermittent reinforcement provides the S with greater resistance to extinction. The study also demonstrated no therapeutic gain for the NR group although the Ss received the attention of their parents during treatment. The twenty minute delay from the onset of enuresis for the NR group was actually non-reinforcing and hence supports the notion of reinforcement through temporal continuity of the CS (bladder stimuli) and UCS (105 db bell and light) leading to the CR arousal as primary to the response acquired. These findings may be interpreted as providing support for the use of the intermittent reinforcement treatment, since there was no therapeutic gain for the NR group; therefore, the improvement of the IR group revealed the capability of reinforcement to initiate behavior change toward attainment of the acquired response.

This study has demonstrated that there was not a significant difference between intermittent and continuous reinforcement in the acquisition of the learned response, i.e. dryness. Yet there was a significant difference between the two groups in terms of relapse rate, i.e. recurrence of enuresis. Therefore, intermittent reinforcement has a significant advantage over continuous reinforcement in the treatment of enuresis.

Although this research has clearly demonstrated the effectiveness of conditioning, especially via the use of intermittent schedules of reinforcement, a number of further research questions may be raised. First, in this study the sex of the parent changing the child's wet bed was not held constant. Future studies should systematically investigate this factor. Secondly, it should be noted that a three month follow-up may not be a sufficient interval of time to monitor relapse rate. However, in view of the very minimal criterion established for dryness in this study, three months seemed at least minimally adequate to assess relapse rate. Future studies should also be conducted to systematically investigate and compare differences among relapse rates according to varying time intervals following acquisition of dryness.

CHAPTER V

SUMMARY

It was hypothesized that intermittent reinforcement during the conditioning treatment of enuresis would be more effective in the reduction of relapse rate than continuous reinfocement. A field experiment with thirty boys between the ages of six to eight years old was conducted to investigate acquisition and extinction parameters of continuous (100 per cent), intermittent (70 per cent variable interval), and control (0 per cent) reinforcement schedules. A Mowrer type conditioning procedure was employed for administration of the reinforced trials. The non-reinfoced trials were administered by a twenty-minute time delay alarm bell (78 decibel) activated in the parent's room as opposed to the reinforced trial alarm bell (105 decibels) activated upon wetting in the S's room. A new conditioning device was developed so that any of the three treatment schedules of reinforcement could be administered by automatic programming. The results of the field experiment showed that continuous reinforcement (CR) and intermittent reinforcement (IR) groups achieved acquisition in approximately the same number of trials and with essentially the same success rate. However, the relapse rate was significantly greater for the CR group than the IR group. The control (NR) group showed no improvement across the six weeks of treatment. Additionally, the IR group displayed a significant learning trend as shown by size of wet spot and latency to onset of first enuretic episode per night, while both the CR and NR groups failed to show learning trends on these variables. The results of this study support the notion that relapse can be viewed and treated as extinction of the acquired response.

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APPENDIX A

INSTRUCTIONS FOR PARENTS OF ENURETIC SUBJECTS

Many hundreds of children have been treated with conditioning instruments and over 90 per cent of them have stopped wetting the bed within about ten weeks.

On the average, treatment lasts about four to six weeks, but it may take as long as two months. About one-third of the children whose bedwetting is stopped, start wetting again and have to use the instrument a second time. For this reason we stress that complete treatment must be thought of as requiring the use of the instrument on two occasions. If your child's bedwetting is stopped permanently after using the instrument once so much the better, but we must plan for a second treatment.

Very few children are not permanently cured after two treatments. Although the chances of curing your child are very good, you must realize that in order to get this result the instructions must be followed precisely. You will find that this requires quite a bit of effort from both you and your child. For example, in the first week or two you may have to get up many times a night, so you must reckon on quite a few disturbed nights. You must keep available as many as five pairs of sheets for your child's bed as he may wet frequently each night and you will have to get up and change his bedding after each wetting. Also, you should have available as many as five changes of sleeping night clothes for your child. An equal number of pillow cases is also necessary since the bedwetting pad is enclosed in a pillow case. Then you will have to keep exact records of the whole treatment on the forms which have been made out for this purpose.

A member of our therapy staff may come to your house each day during treatment (including Saturdays, Sundays, and holidays). At no time during the course of treatment should the procedure be interrupted. To do so could seriously impair the treatment process, and your child would have to be terminated from treatment.

PROGRAMMED ENURESIS TREATMENT (PET)

Instructions To Parents In The Use Of PET

Introduction

When you saw PET for the first time you probably felt that it was too complicated and that you could never learn how to work it. However, PET has been designed so that there are only two switches and one blue light which you must learn how to operate. The rest of PET's functions are totally automatic.

There are three attachments to PET which you should also be familiar with. The first is the pad on which your child must sleep. This pad must be placed on the bed, preferably enclosed in a pillow case or under the bottom sheet of your child's bed. A wire runs from PET to the pad. Underneath the pad the wire is attached to two snaps. You must check each night to make sure these snaps are fastened securely to the pad.

The second attachment is a large red bell which is connected to PET by a cord and plug. This bell is very loud. When it rings, this means your child has just wet his bed. Sometimes you will never hear it ring throughout the course of treatment. Instead a small bell will ring in the parents' room. The small bell is about as loud as the ring of a telephone. Enough wire has been provided to make sure that the small bell in the parents' room will reach to PET in the child's room.

Instructions

1. Make sure PET is plugged in the wall socket each night.

2. There are two switches on PET which you must learn to operate. The first is a small switch in the upper corner of PET. It is labeled

   ON
OFF
TEST.

   You should make sure, when your child goes to bed each night, that the small switch is placed in the ON position. The position of the switch is up. To be absolutely certain, you should pull the switch up gently with your finger. You should never place the small switch in any other position than ON. It is all right to leave this switch ON all day long when the pad is not in use, so long as the pad is dry. Also, no metal objects should be placed on or left on the pad. To do so would either cause one of the bells to ring and/or would run down the batteries of PET.

3. The other switch you must learn to operate is the big switch located in the center of PET near the top, next to the blue light. When you put your child to bed, the big switch should be positioned up. The up position is labeled

LIGHT OFF
READY.

When your child wets, one of the two bells will start to ring. When youhear the bell, you go to your child's room. You will note a light has been turned on by PET when the loud bell is ringing. To turn off either bell and/or the light, push the center switch to the BELL OFF
LIGHT ON
position. Just push the center switch down. One light will go off and another will come on. The one that comes on is the service light. Also you will note the blue light has gone out. The blue light simply tells you the pad is still wet. You should then remove your child from the bed, dry him off, and put him in dry clothing. Then remove the wet pad from the bed (remove it from pillow case or from under bottom sheet) and dry it off with a towel. The pad is not adequately dry until the blue light goes out. Be careful not to disconnect the snaps from underneath the pad. If one should come loose, just snap it back on.

Change all the wet bedding. Make sure the bed is absolutely dry. Place the dry pad back on the bed either in a new pillow case or under the bottom sheet. Check the snaps again to make sure they are connected to the pad. Put your child back in bed, making sure he is completely dry. Check after putting him back in bed that the blue light is off. If the blue light is on, the pad is still wet and needs to be dried. Once the blue light is off and your child is back in bed, flip the big center switch back up. This will turn off the service light and you may go back to bed. Be sure to note the time on the score form and to measure the width of the wet spot before changing the bedding.

Below is a list of events and what you should do.

1. Make sure PET is plugged into wall socket each night.

2. Make sure small switch in upper corner of PET is in ON position.

3. Make sure big center switch of PET is up in the
LIGHT OFF
READY position.

4. Make sure pad is placed properly on bhild's bed and is dry.

5. Make sure wire from PET is securely attached at the two snaps underneath the pad.

6. Turn out lights and go to bed.

7. You and your child are asleep when one of two bells begins to ring.

8. Rush to child's room. Note blue light on PET is on, and a light over or near child's bed is on.

9. Place center switch near blue light in BELL OFF / LIGHT ON position.

10. This will turn off whichever bell is ringing and turn off one light and turn on a service light. The blue light will still be on.

11. Record time of night on score sheet. This will require that a clock or watch be nearby.

12. Get your child out of bed, dry him off completely, and place him in dry night clothes.

13. Get yardstick or ruler and measure size of wet spot on pad and bed. Then record on score sheet.

14. Remove wet pad from bed and dry it off. As soon as pad is dry, blue light will go off automatically. If pad appears to be dry, the pad may still be damp if blue light remains on. Blue light will go off with sufficient evaporation.

15. Change wet bedding--remove wet sheets and blankets and replace with dry sheets and blankets.

16. Place dry pad in dry pillow case or under dry sheets. Check to make sure snaps are securely attached to pad.

17. Place child back in bed.

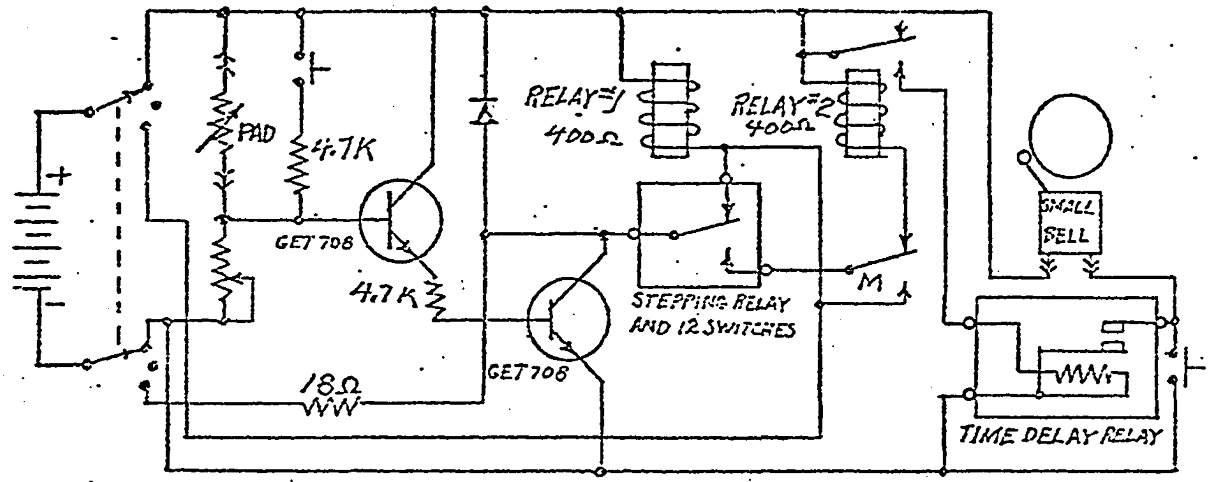
18. Return big center switch to LIGHT OFF / READY position. This will turn off service light.

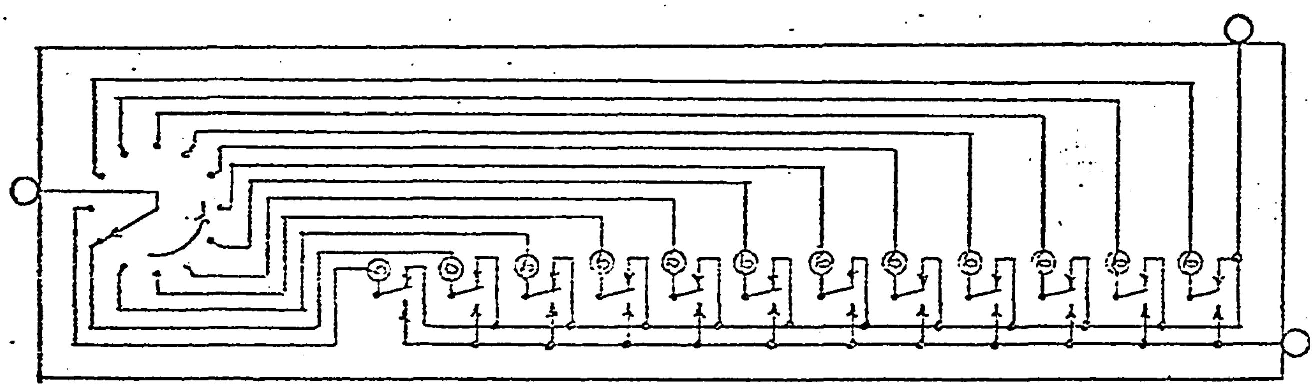
19. Tell child good night and then go to bed.

20. If bell should go off again go to step 7 of these instructions.

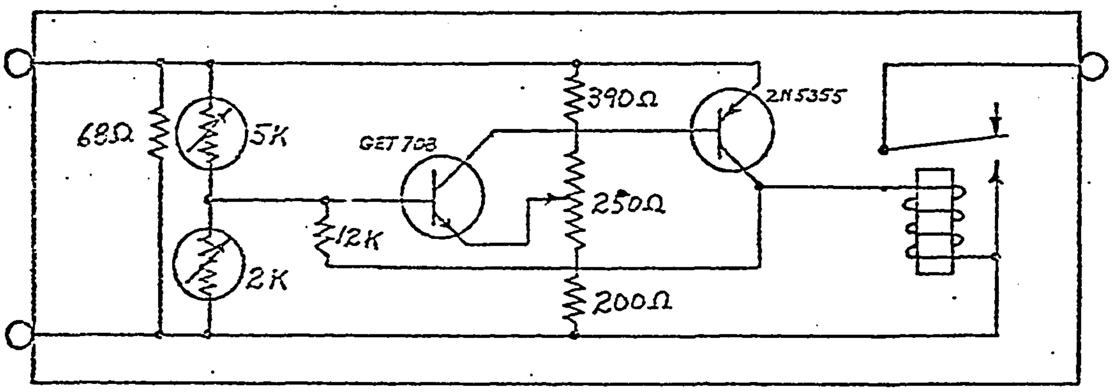
APPENDIX B

ENURESIS TREATMENT ALARM SYSTEM

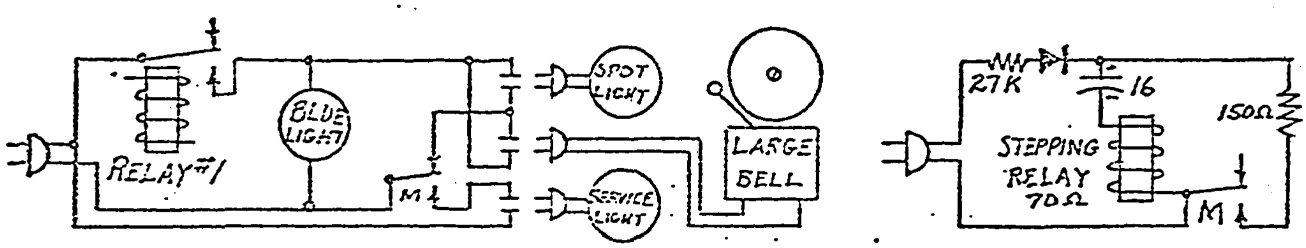




STEPPING RELAY AND 12 SWITCHES



TIME DELAY RELAY



APPENDIX C

PROGRAMMED ENURESIS TREATMENT

SUBJECT ____________

STUDY: PET I

DATE	1	2	3	4	5	6	7	8	9	10	11
BED TIME											
1st wetting time											
Big bell or little bell											
Size of wet spot											
2nd wetting time											
Big bell or little bell											
Size of wet spot											
3rd wetting time											
Big bell or little bell											
Size of wet spot											
4th wetting time											
Big bell or little bell											
Size of wet spot											
5th wetting time											
Big bell or little bell											
Size of wet spot											

COMMENTS:

DATE	12	13	14	15	16	17	18	19	20	21	22	23
BED TIME												
1st wetting time												
Big bell or little bell												
Size of wet spot												
2nd wetting time												
Big bell or little bell												
Size of wet spot												
3rd wetting time												
Big bell or little bell												
Size of wet spot												
4th wetting time												
Big bell or little bell												
Size of wet spot												
5th wetting time												
Big bell or little bell												
Size of wet spot												

DATE	24	25	26	27	28	29	30	31	32	33	34	35
BED TIME												
1st wetting time												
Big bell or little bell												
Size of wet spot												
2nd wetting time												
Big bell or little bell												
Size of wet spot												
3rd wetting time												
Big bell or little bell												
Size of wet spot												
4th wetting time												
Big bell or little bell												
Size of wet spot												
5th wetting time												
Big bell or little bell												
Size of wet spot												

COMMENTS:

APPENDIX D

SCHEDULE OF REINFORCEMENT FOR INTERMITTENT GROUP

ON INDIVIDUAL BASIS

S I

1	R						
2	R						
3	R	38	NR	68	R	98	R
4	R	39	R	69	NR	99	R
5	R	40	R	70	R	100	R
6	R	41	R	71	R	101	NR
7	R	42	R	72	R	102	R
		43	NR	73	R	103	R
8	NR	44	NR	74	R	104	R
9	NR	45	R	75	NR	105	NR
10	R	46	R	76	NR	106	NR
11	R	47	R	77	R	107	R
12	R						
13	R	48	NR	78	R	108	R
14	R	49	R	79	R	109	R
15	R	50	R	80	NR	110	NR
16	NR	51	R	81	R	111	R
17	R	52	NR	82	R	112	NR
		53	R	83	NR	113	R
18	NR	54	R	84	R	114	R
19	R	55	R	85	R	115	NR
20	R	56	NR	86	NR	116	R
21	R	57	R	87	R	117	R
22	NR						
23	R	58	R	88	R	118	R
24	R	59	NR	89	NR	119	R
25	NR	60	R	90	R	120	R
26	R	61	R	91	R	121	R
27	R	62	R	92	NR	122	R
		63	R	93	R	123	R
28	R	64	R	94	R	124	R
29	NR	65	R	95	NR	125	NR
30	R	66	NR	96	R	126	NR
31	R	67	NR	97	R	127	NR
32	R						
33	NR						
34	R						
35	NR						
36	R						
37	R						

R = REINFORCEMENT
NR = NO REINFORCEMENT

S II

1 R
2 R
3 R
4 R
5 R
6 R
7 R

8 R
9 R
10 NR
11 R
12 R
13 NR
14 R
15 R
16 R
17 NR

18 R
19 NR
20 R
21 NR
22 R
23 R
24 R
25 R
26 NR
27 R

28 R
29 R
30 R
31 R
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33 NR
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107 R

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110 R
111 NR
112 NR
113 R
114 R
115 R
116 NR
117 R

118 R
119 R
120 NR
121 R
122 R
123 NR
124 R
125 R
126 NR
127 R

S III

1	R
2	R
3	R
4	R
5	R
6	R
7	R
8	R
9	NR
10	NR
11	R
12	R
13	R
14	R
15	R
16	NR
17	R
18	R
19	NR
20	R
21	NR
22	R
23	R
24	R
25	R
26	R
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29	NR
30	R
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39	R
40	NR
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45	R
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47	NR
48	R
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53	R
54	NR
55	R
56	R
57	R
58	R
59	R
60	R
61	NR
62	R
63	R
64	NR
65	R
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APPENDIX E

TULSA PUBLIC SCHOOLS NEWSLETTER ARTICLE

(February, 1972) Team to Study 30 Bedwetters

Bedwetting, long a hidden and hush-hush subject, is emerging into the spotlight of intensive medical and scientific research. In fact, researchers at Children's Medical Center are openly seeking 30 children, aged 6 through 8, for a study on treatment of enuresis (bedwetting).

Dr. William W. Finley, research psychologist, heads the research team which expects that most children treated in the study will stop wetting the bed.

Children accepted for the project must consistently wet the bed three or more times a week. Treatment procedure will be conducted at the child's home through a simple form of learning, or "conditioning." The treatment apparatus, Programmed Enuresis Treatment (PET), will be installed in the home for approximately a month, the expected length of treatment.

No electric shocks or drugs will be given, and there is no danger from treatment. Safety and effectiveness of the apparatus have been checked by Children's researchers.

No fee is charged for participation in the study, although each child is required to have a physical examination which may be completed by the family physician.

Applications are being sought immediately. For complete details, parents with enuretic children may call Dr. Finley at Children's Medical Center, 749-2281, extension 307.

APPENDIX F

RAW DATA

NUMBER OF WETTINGS PER WEEK

CR GROUP

Subject	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
1	10	6	1	0	0	0
2	3	0	0	0	0	0
3	13	6	1	4	3	0
4	13	2	0	0	0	0
5	8	1	1	0	0	0
6	10	0	0	0	0	0
7	5	8	0	0	0	0
8	2	0	0	0	0	0
9	9	0	0	0	0	0
10	5	6	8	7	3	2
$\bar{X}$	7.8	2.9	1.1	1.1	0.6	0.2
S.D.	3.91	3.21	2.46	2.42	1.26	0.63

IR GROUP

Subject	1	2	3	4	5	6
11	1	3	2	0	0	0
12	4	3	5	5	0	0
13	11	10	0	0	0	0
14	9	11	10	10	5	4
15	2	7	2	0	0	0
16	7	6	1	2	1	1
17	14	4	0	0	0	0
18	11	3	1	1	0	0
19	11	12	8	13	3	0
20	10	5	3	3	0	0
$\bar{X}$	8.0	6.4	3.2	3.3	0.9	0.5
S.D.	4.34	3.47	3.42	4.66	1.72	1.26

NUMBER OF WETTINGS PER WEEK

NR GROUP

Subject	WEEKS 1	2	3	4	5	6
21	8	12	12	13	14	12
22	8	8	8	6	7	12
23	6	4	4	7	5	4
24	8	8	8	8	6	2
25	7	8	7	4	6	1
26	12	4	9	13	12	11
27	5	5	10	10	6	5
28	8	5	5	5	5	4
29	6	11	9	11	9	11
30	9	9	6	7	6	12
$\bar{X}$	7.7	7.4	7.8	8.4	7.6	7.4
S.D.	1.90	2.83	2.39	3.20	3.09	4.57

NUMBER OF WET NIGHTS PER WEEK

CR GROUP

Subject	WEEKS 1	2	3	4	5	6
1	3	4	1	0	0	0
2	3	0	0	0	0	0
3	6	3	1	3	3	0
4	7	2	0	0	0	0
5	6	1	1	0	0	0
6	7	0	0	0	0	0
7	5	4	0	0	0	0
8	2	0	0	0	0	0
9	7	0	0	0	0	0
10	5	5	5	5	3	1
$\bar{X}$	5.1	1.9	0.8	0.8	0.6	0.1

IR GROUP

Subject	1	2	3	4	5	6
11	1	2	2	0	0	0
12	4	3	5	4	0	0
13	6	7	0	0	0	0
14	6	6	7	7	3	4
15	1	5	1	0	0	0
16	6	4	1	2	1	1
17	7	3	1	1	0	0
18	6	2	0	0	0	0
19	6	7	4	6	3	0
20	6	5	3	3	0	0
$\bar{X}$	4.9	4.4	2.4	2.3	0.7	0.5

NUMBER OF WET NIGHTS PER WEEK

NR GROUP

Subject	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
21	7	7	7	7	7	7
22	6	5	7	6	6	6
23	5	4	3	5	4	4
24	7	6	6	7	5	2
25	5	7	6	4	5	1
26	6	4	4	7	7	7
27	5	4	7	6	4	3
28	6	5	5	5	5	4
29	6	6	7	7	7	7
30	7	7	6	7	5	6
$\bar{X}$	6.0	5.5	5.8	6.1	5.5	4.7

LATENCY IN MINUTES TO FIRST WETTING/ NIGHT

CR GROUP

Subject	$\bar{X}$	r
1	262.22	0.12
2	190.00	-0.83
3	198.75	-0.17
4	190.00	-0.69
5	226.00	0.29
6	252.86	0.34
7	194.00	-0.08
8	152.50	-1.00
9	172.86	-0.24
10	346.14	-0.02
G.M.	218.53	-0.45
S.D.	56.26	

IR GROUP

Subject	$\bar{X}$	r
11	195.00	0.54
12	288.25	-0.17
13	215.00	-0.21
14	231.36	0.25
15	228.57	0.25
16	362.33	0.47
17	160.50	-0.17
18	344.33	0.25
19	235.34	0.00
20	276.87	0.48
G.M.	253.75	0.18
S.D.	63.98	

NR GROUP

Subject	$\bar{X}$	r
21	204.51	0.06
22	290.83	-0.00
23	237.41	-0.21
24	336.81	0.34
25	302.00	-0.02
26	230.83	-0.20
27	191.20	-0.08
28	267.50	-0.25
29	325.50	0.07
30	323.03	0.00
G.M.	270.96	-0.02
S.D.	52.60	

NUMBER OF NIGHTS TREATED

CR GROUP Subject	NIGHTS	IR GROUP Subject	NIGHTS	NR GROUP Subject	NIGHTS
1	24	11	28	21	42
2	11	12	34	22	42
3	42	13	21	23	42
4	16	14	42	24	42
5	22	15	22	25	42
6	14	16	41	26	42
7	18	17	16	27	42
8	13	18	29	28	42
9	14	19	39	29	42
10	41	20	34	30	42
$\bar{X}$	21.5	$\bar{X}$	30.6	$\bar{X}$	42.0
S.D.	11.27	S.D.	8.94	S.D.	0.0

NUMBER OF REINFORCEMENTS

CR GROUP Subject	REINFORCEMENT	IR GROUP Subject	REINFORCEMENT
1	17	11	5
2	3	12	15
3	26	13	14
4	15	14	36
5	10	15	10
6	10	16	14
7	12	17	16
8	2	18	14
9	9	19	34
10	27	20	18
$\bar{X}$	13.1	$\bar{X}$	17.6
S.D.	71.21	S.D.	96.93

SIZE OF WETSPOT IN INCHES

IR GROUP

											S.D. 2.17
Reinforced	7.8	8	11.9	5.8	9.3	7.5	5.7	4.6	6.4	5.3	$\bar{X}$=7.26
Non-Reinforced	24	8.5	24	14	16	7.2	16.5	4.1	8.5	7.5	$\bar{X}$=13.05
											S.D. 7.04