AN ANALYSIS OF SLEEP DEPRIVATION FACTORS AND CONSEQUENCES OF STAYING AWAKE IN THE STIMULUS CONTROL TREATMENT OF SLEEP DISTURBANCES

by

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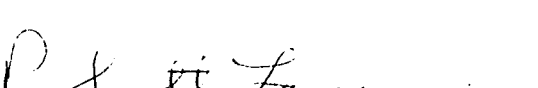

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In this study two independent variables were manipulated: sleep deprivation and behaviors performed once out of bed. The sleep deprivation variable involved subjects sleeping for either seven or nine hours a night. The behaviors performed factor consisted of subjects performing either pleasant or aversive behaviors when they got out of bed after not being able to fall asleep within ten minutes. There were seven conditions in this study: high sleep-deprivation, unpleasant; low sleep-deprivation, unpleasant; high sleep deprivation, pleasant; low sleep-deprivation, pleasant; high sleep deprivation, neutral; low sleep-deprivation, neutral; and a placebo-control group. All treatment conditions except the placebo-control group received Bootzin's (1972) stimulus control treatment of insomnia. After filling out one week of daily sleep forms, 48 college subjects who had average latency to sleep onsets of 60 minutes or greater for three or more days out of the week were selected for the study. The latency scores for these subjects were rank ordered and blocked; then the subjects were randomly blocked into treatment groups. The subjects were seen in individual therapy sessions once per week for five weeks. At the conclusion of the first session all subjects filled out two 10-point scales which rated the logic of and their expectancy of improvement

generated by the rationales of the procedures. Follow-up consisted of all subjects filling out one week of daily sleep forms three weeks subsequent to the end of the last therapy session. Fifty percent of the subjects' roommates cooperated with the study by unobtrusively noting aspects of the subjects' sleep behavior, thereby providing reliability measures on time to bed, times out of bed prior to sleep, time to sleep, times awakened, time up and on the independent variable manipulations. The reliability coefficients ranged from .63 to 1.0 with approximately 90 percent of the reliability coefficients being .82 or greater.

The sleep-deprivation and behaviors-performed hypotheses were partially supported by the fact that the high sleep-deprivation, unpleasant group had a pattern of superior performances on the dependent measures, difficulty getting to sleep, number of times out of bed, number of times out of bed for each night out of bed, and the number of days out of bed. The clinical implications of these findings are discussed in this paper. Possible factors which led to the lack of significant differences among treatment groups with regard to latency to sleep onset are also discussed. All six active treatment groups significantly reduced their latencies to sleep onset from baseline to follow-up week relative to the placebo-control group. These findings provide support for the therapeutic effectiveness of stimulus-control approaches. Future recommendations are given for studying the sleep-deprivation and behaviors-performed hypotheses.

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CHAPTER I

INTRODUCTION

The clinical term "insomnia" has had many different definitions based upon the particular viewpoint of each researcher in this field. Due to this terminological confusion in the literature, the term "insomnia" in this paper will be dropped, and in its place the term "sleep disturbance" will be used. An objective definition of a "sleep disturbance" could be arrived at by using Monroe's (1967) definition of a "poor sleeper." He states that

> the minimum requirements of poor sleepers would be that they: (a) usually take 60 minutes or longer to fall asleep and always more than 30 minutes; (b) usually wake up at least once during the night; and (c) usually experience considerable subjective difficulty in falling asleep, independently of how long it takes to fall asleep. (Monroe, 1967, p. 256)

Although the specific incidence of sleep problems in the population is not known, Borkovec and Fowles (1973) found that 18% of an undergraduate psychology class of 650 students felt they had sleep problems which were sufficiently bothersome to seek treatment to eliminate their occurrence.

The research attempting to study sleep disturbances has been sparse. Most studies have utilized drugs (McGraw & Oliven, 1959), mainly barbiturates, which, although occasionally temporarily effective, have very minimal extra-therapeutic generalization once they are terminated.

Similar criticisms also apply when hypnosis (Wolberg, 1954) is used as a treatment of sleep disturbances.

Clinicians who conduct research in university settings comparing the efficacy of various treatment techniques have focused primarily on analogue fears such as snake phobias and the like. Borkovec and Fowles (1973) feel that the study of sleep disturbances is more clinically relevant than these analogue fears for two reasons: (a) a large number of both outpatient and inpatient populations report sleeping disturbances (an estimated 20 million people suffer from sleep disturbances in the United States alone), and (b) sleep disturbances as a problem are more likely to disrupt and interfere with daily functioning than are the frequently used analogue fears. It therefore appears that the area of sleep disturbances offers significant research potential and, as such, deserves more scrutiny than it has received. Research which deals with the behavioral treatment of sleep disturbances will now be discussed. Treatment strategies will be covered in the following order: case studies, group approaches, the use of relaxation training, and finally stimulus control procedures.

Case Studies

One of the first behavioral case studies to treat sleep disturbances involved a variant of systematic desensitization (Geer & Katkin, 1966) in which a single female subject

was treated successfully (in a clinic) using relaxation procedures combined with a single item for visualization, since the subject reported an absence of anxiety prior to entering her bed. The single item which the subject visualized was getting into bed, feeling relaxed, and falling asleep within a few minutes. In an eight-month follow-up, the client reported that on occasion it would take her two to three hours to get to sleep, but that this occurred only once every two weeks. It would appear from the follow-up reports that this client did reduce the frequency of these long latencies.

A recent case study was performed by Weil and Goldfried (1973) on an 11-year-old girl who was suffering from sleep disturbances. She was treated initially in a clinic and then at home, utilizing self-relaxation tapes which consisted of instructions for alternate tensing and relaxing of various muscle groups, combined with instructions to "shut out all external noises and ruminations." The use of these relaxation tapes by the client eliminated her difficulty in falling asleep at night.

Another case study by Evans and Bond (1969), which was performed in a clinic, involved a male graduate student who received fourteen therapy sessions which utilized systematic desensitization in a single-item form identical to that used by Geer and Katkin (1966). For the next eight sessions, he received four conditioning trials with methohexital sodium.

Each trial consisted of the subject counting from one to twenty-eight. When the patient began to count, four cubic centimeters of a 5% solution of methohexital sodium was injected, and this resulted in sleep when the patient reached twenty-eight. The patient then slept for three to four minutes, and then the next trial was begun. Methohexital conditioning resulted in an almost normal sleep pattern, a state which the patient had been unable to obtain for almost seven years. Systematic desensitization therapy did not produce any significant change in his sleeping pattern. As does Geer and Katkin's (1966) case study, this case suffers from a lack of controls, thereby making it difficult to attribute therapy changes solely to the methohexital sodium conditioning.

Group Treatment Approaches

The first group treatment procedure for the therapy of sleep disturbances was attempted by Kahn, Baker, and Weiss (1968). They used 16 subjects, who reported in a premeasure a median estimated time to sleep of 52 minutes. The treatment involved two 30-minute group-training sessions per week for two weeks, utilizing a relaxation technique called Autogenic training (Schultz & Luthe, 1959), which appears to be similar to hypnotic relaxation (Paul, 1969). Of the 13 subjects in the postinterview, 11 reported improvement (3 very much better; 8 some better), and two reported no improvement. Unfortunately, this study lacked a control for

the possibility that the improvements were not merely due to remittance over time. Eisenman (1970) criticized this study for (a) the confounding of the relaxation procedure with Rogerian interviewing, (b) the possibility of demand characteristics influencing the outcome data, and (c) the use of only self-report measures as an improvement index. Although Baker and Kahn (1972) defended the use of their self-report measure adequately, the inclusion of control groups is the only method of alleviating the remaining two criticisms of Eisenman (1970).

Three other studies have investigated sleep disturbances in terms of an attribution formulation (Davison, Tsujimoto, & Glaros, 1973; Kellog & Baron, 1975; Storms & Nisbett, 1970). In the Storms and Nisbett study subjects, all of whom had reported sleep problems, were given placebo pills to take just prior to bedtime. Some subject were told that the pills would cause arousal, and others were told that the pills would reduce arousal. Subjects took less time than usual to get to sleep when they were told to expect arousal, presumably because they attributed their arousal to the pills rather than to their emotions and, as a consequence, were less emotional. In a parallel way, subjects took longer than usual to get to sleep when they were told to expect sedation, presumably because they assumed that their emotions were unusually intense since their arousal level was high, even after taking a supposed arousal-reducing agent.

The use of deception and the reliance on placebo pills, from a practical clinical standpoint, cause this study to have limited value to a viable therapeutic procedure for sleep disturbances.

Another study investigating attribution theory and sleep disturbances (Kellog & Baron, 1975) failed to confirm the major results of the Storms and Nisbett (1970) study, even though the procedures were similar. Using 42 subjects with an average latency to sleep during the baseline week of 45.3 minutes, the design varied whether pills were administered (pill), or withheld (no pill), and whether high justification was provided (HJ) or not (NJ) for the taking of the pills. Subjects in the pill HJ and no pill HJ groups were told by the experimenter that they were making a large contribution to science and that the results from the study were going to be very important. The pill NJ and no pill NJ were treated as were the original arousal and control groups used in the Storms and Nisbett (1970) study. The subjects in the NJ conditions were not told anything regarding contributions to science and essentially were control conditions. All subjects in the pill conditions were told that they would experience increased arousal (i.e., warm feelings, increased heart rate, etc.) when they took the pill at bedtime. Instead of a decrease in latency to sleep onset, the subjects in the pill NJ condition increased their latency to sleep onset. Recall that similarly treated subjects in the Storms

and Nisbett (1970) study decreased their latency to sleep onset. The results of the Kellog and Baron (1975) study cast suspicion on the Storms and Nisbett (1970) results and research in this area will be needed to determine the reasons for the apparent discrepancy.

The Davison et al. (1973) study used essentially a Davison-Valins attribution hypothesis, which assumes that behavior changes believed to be due to an external agent, like a drug, generalize less to the post-treatment situation than changes believed to be due to one's own efforts. All subjects were given 1,000 milligrams of chloral hydrate each night and were instructed in self-relaxation procedures developed by Bernard Weitzman (1967). Following treatment, half of the subjects were informed that they had received an optimal dosage, and the balance of the subjects were told that they had received a dosage which was too weak (minimal dosage) to have produced any changes. Then the subjects were told to discontinue the drug and to merely use self-relaxation during the post-treatment week. As predicted, greater maintenance of therapeutic gain was achieved by those in the minimal dosage group, who could not attribute their changes to the drug; however, Davison et al. (1973) state, "we do not purport to furnish a treatment for insomnia" (p. 132) and, judging from the posttreatment latencies to sleep onset for the two groups (62.4 and 36.6 minutes), this statement is understandable. Instead, the purpose of this endeavor was to alert clinicians

> to the possibility that the manner in which clients explain to themselves the reasons they have enjoyed therapeutic improvement may be one of an as yet undefined number of important factors in the maintenance of behavior changes. (p. 132)

Relaxation Training for the Treatment of Sleep Disturbances

Lacking in all the previously mentioned studies is a concisely controlled investigation which analyzes several unconfounded treatment conditions in a between-subject design. Borkovec and Fowles (1973) have recently executed a study which fulfills these prerequisites. Their study incorporated 37 subjects, who had an average latency to sleep onset of 44 minutes during baseline. These subjects were then matched on latency to sleep onset and assigned to one of four treatment conditions: (1) progressive relaxation, which involved the systematic tensing and relaxing of various muscle groups of the body, with indirect suggestions of relaxation; (2) hypnotic relaxation, which involved direct suggestions of relaxation (see Paul, 1969, for more details); (3) self-relaxation, which had subjects practice relaxing themselves by concentrating on neutral imagery and on the resultant feelings of relaxation in the muscles of the body (the authors viewed this as essentially a control condition); and finally (4) a no-treatment control condition. After three one-hour therapy sessions, progressive and hypnotic relaxation groups showed significantly greater improvement than no-treatment, while self-relaxation produced improvement nearly equal to the progressive and hypnotic

relaxation conditions. The self-relaxation group did not differ significantly, however, in improved sleep latencies from the no-treatment control group. Thus, since the two treatment groups did not differ significantly from the placebo-control group, the results from the two active treatment groups could possibly be due to suggestion, therapist contact, or expectations for improvement, instead of the treatment techniques per se. Alternatively, since the placebo subjects were asked to focus on the feelings of relaxation in their muscles, it seems possible that this condition might have had some therapeutic effects and in actuality was not a placebo-control.

Another controlled group study was performed by Steinmark and Borkovec (1974). They used four groups: (a) progressive relaxation, (b) desensitization, (c) placebo, and (d) waiting-list no-treatment. The desensitization procedure involved the same relaxation training as was employed in the progressive relaxation group and used a single-item hierarchy identical to the one used by Geer and Katkin (1966). The placebo condition involved a quasi-desensitization procedure. Each placebo subject constructed an 18-item hierarchy of chronological bed-time activities and chose six neutral images to be paired with the hierarchy items. The 52 subjects were college students who had latencies to sleep onset of 31 minutes or more. These subjects were ranked on latency to sleep onset as determined in the pretreatment interview and were randomly assigned within severity blocks to the four groups. There

were four group sessions over four weeks for the three groups, with the size of a group ranging from five to seven subjects. The no-treatment subjects were told that current treatment groups were filled, but that new groups would be formed in four weeks. There was a five-month follow-up in which subjects were contacted by phone and asked to estimate their latencies to sleep onset. Two novel features of the study were credibility evaluations and counter-demand statements. The credibility evaluation involved subjects in this study rating their respective therapy conditions on a series of credibility scales. The counter-demand instructions consisted of all treated subjects being told not to expect improvement in sleep disturbance until after the fourth therapy session. These instructions were used to control for experimental demand characteristics. Analyses indicated that the latencies to sleep onset decreased for the relaxation and desensitization groups from pre-therapy week to week four as compared to placebo and no-treatment groups. The follow-up data indicated trends similar to the other analyses--namely, that relaxation and desensitization groups continued to maintain these superior improvements. The three treatment groups all showed equal ratings of credibility as indicated by a one-way analysis of variance.

One problem with this study was the assignment of subjects to therapy conditions on the basis of only one pretherapy interview. This procedure could result in inaccurate latency

predictions because of a limited assessment period. A more rigorous experimental method would be to have subjects conduct a week of baseline subsequent to the pretherapy interview. Then, at the week's end subjects would be screened out if their latencies to sleep onset failed to meet the criterion, and those subjects that remained could then be blocked into treatment groups (see Tokarz & Lawrence, 1974).

Another problem found in this study was that the five-month follow-up was conducted by phone and only means were computed on these data. The nature of phone assessments could place a high demand upon the subjects to reply as they believed the experimenter wished. The mailing of a packet of seven daily sleep questionnaires to subjects at follow-up might lessen demand characteristics. With regard to statistical analysis, it would have been more desirable to perform an analysis of variance on the data from pretherapy through to follow-up. Without such data, statements regarding the long-term efficacy of the treatments used in this study could be a bit tenuous. Borkovec, Kaloupek, and Slama (1974) did a study similar to the one just cited in an effort to replicate the above effect. This study was identical in subject selection, method, and all other features except that another control group was added. The procedures of this control group were identical to those of progressive relaxation, with the exception that tension-release of muscle groups was omitted. This condition was included to

determine if progressive relaxation was effective due to its tension-release or due to attention focusing. Because this control condition involved only the attention-focusing component, the relative effects of tension-release could be assessed. There were 56 subjects in this study, and the structure of treatments and the duration of treatments was identical to those of Steinmark and Borkovec (1974). Progressive relaxation produced significantly greater improvement in reported latency to sleep onset than the three control conditions prior to the final session and was the only condition to display greater improvement than no-treatment after the final session. A five-month follow-up revealed further gains for the progressive relaxation group. It was concluded that muscle tension-release appears to be a critical procedural component in the active treatment of sleep disturbances. The criticisms leveled at the Steinmark and Borkovec (1974) study apply to this study as well, except for the criticism regarding statistical analysis of follow-up data.

A study was performed by Borkovec, Steinmark, and Nau (1974) to compare relaxation and desensitization in order to determine if each one alone could be as effective as both together for the treatment of sleep disturbances. The three treatment conditions were: relaxation alone, desensitization with relaxation, and desensitization without practice. In the two desensitization groups, the single-item hierarchy used was identical to the one used in Geer and Katkin's

study (1966). Twenty-four subjects who had latencies to sleep onset of 31 minutes or greater were recruited by newspaper advertisements and were randomly assigned and blocked into three groups based on one pretherapy interview. Three group treatment sessions, approximately one week apart, were given to each group; no follow-up was conducted. The results indicated that all groups significantly improved their latencies to sleep onset across all phases of the study. Thus, there were no significant differences between groups, and the week-by-treatment interaction was also not significant. The absence of control conditions and the lack of a significant treatment-by-phase interaction makes the evaluation of differential treatment effectiveness in this study a bit difficult.

Progressive relaxation was compared to autogenic training in a controlled group design study by Nicassio and Bootzin (1974). This is the first study to use a clinical population: sample of subjects with sleep disturbances had severe, chronic sleeping problems (subjects averaged about 120 minutes a night to fall asleep), were drawn from the general community, and volunteered to receive help rather than to receive money or to fulfill a course requirement. The treatment conditions were: progressive relaxation, autogenic training, self-relaxation control, and no-treatment control. The progressive relaxation condition was an abbreviated form of the Jacobson (1938) procedure. The autogenic training was developed by Schultz and Luthe (1959)

and consists of the subject relaxing by repeating suggestions of warmth and heaviness to himself over and over again. In the self-relaxation control condition subjects were merely told that everyone knows how to relax and that it is just a matter of scheduling time to do so. They were encouraged to practice self-relaxation in their own way each day. In the no-treatment control condition subjects were told that an extended baseline period was needed, and they were given daily sleep forms to fill out for the next four weeks. The subjects were obtained through advertisements placed in a local newspaper. The subjects were then interviewed and asked to keep daily sleep records for a week. Those subjects (N=30) whose average daily time to fall asleep exceeded 30 minutes were randomly assigned to the four groups. The treatment was done individually and lasted four weeks. During this period, subjects received four one-hour treatment sessions. The results indicated that progressive relaxation and autogenic training were equally effective at reducing the latency to sleep onset as compared to both control groups. A six-month follow-up was performed by having subjects fill out seven days of sleep forms. Correlated t tests demonstrated that both treatment groups were still superior to the self-relaxation control with regard to latency to sleep onset.

This study is notable first for being the first study to utilize a pretherapy baseline week for screening subjects prior to assigning them to treatment groups. Secondly,

the follow-up measure involved filling out a week of daily sleep forms six months from the last treatment session. Finally, it demonstrated that progressive relaxation and autogenic training can be used as successful treatment techniques with severe clinical sleep disturbances.

Gershman and Clouser (1974) compared relaxation training to systematic desensitization in a group design. Two of the groups were no-treatment control conditions. In one control group, subjects either had moderate to great difficulty getting to sleep (poor-sleep control group); in the other group subjects had no problem getting to sleep (normal-sleep control). The hierarchy for the systematic desensitization group was determined by the subjects' responses on a sleep survey questionnaire and by the experimenter's casual conversations with the subjects. From this information, the experimenters constructed a standard hierarchy for all systematic desensitization subjects.

Subjects were assigned to treatment groups based upon answers to a sleep questionnaire which indicated whether they had moderate or great difficulty falling asleep. The average latency to sleep onset for the final group of subjects (total N=30) was 65 minutes. The therapy sessions were 30-40 minutes long and were conducted in groups with two sessions per week for four weeks. All sessions of the two treatment groups were presented via tape-recorded instructions. The control groups merely had two assessments of their sleep problems: pre- and

posttherapy. A 12-month follow-up was conducted on 13 of the treatment group subjects. The results indicated that both treatment groups significantly decreased their latencies to sleep onset from pre- to posttherapy estimates as compared to both control groups. Decreases in latency to sleep onset were maintained as assessed at follow-up for the two treatment groups.

There were several problems inherent in this study. First, the desensitization group and the muscle relaxation group had respective medians in latency to sleep onset of 75 and 53 minutes during pretherapy measures; however, there was no attempt made to control for these pretherapy differences by a blocking technique. Boneau and Pennypacker (1961) caution against such random assignment by stating that simple random assignment of subjects to groups can restrict the probability of achieving significant differences between groups. It is therefore preferable to have subjects blocked on the relevant dependent measure and assigned to groups from this blocking. Another alternative to blocking would be to have groups comprised at random and then use a posttest-only design where no pretest measures are taken at all. Secondly, a placebo-control group could have been used to control for the various aspects of therapist contact, experimental demand characteristics, and other nonspecific therapy procedures.

An unpublished group-design study was performed by Tokarz (1974) in which 50 college students who had latencies to sleep onset of 31 minutes or longer each night were systematically assigned on this latency measure to one of five groups: relaxation training (modeled after Bernstein & Borkovec, 1973), self-regulation of thoughts (a technique similar to "thought-stopping"; Wolpe, 1969), combined treatment (a combination of the first two techniques), group discussion (placebo group in which no direct therapeutic techniques were employed), and delayed-treatment control (which received the combined treatment subsequent to follow-up). There were four group treatment sessions over two weeks. The first session lasted 45 minutes, and the others were 30 minutes long. All three treatment conditions were taped; the placebo condition was live. The follow-up was conducted five weeks after the last therapy session and consisted of subjects' filling out daily sleep forms for seven days. There was a significant reduction from baseline to follow-up across all treatment groups (including the placebo group) for the following three dependent measures: latency to sleep onset, difficulty getting to sleep, and number of times awakened. A novel feature of the experiment was the utilization of roommates to monitor subjects' sleep patterns. Roommates were reliably able to corroborate the subjects' reports regarding: time to bed, time to sleep, latency to sleep onset, and time up in the morning. Although this experiment

did not demonstrate significant differences between groups with regard to latency to sleep onset, it documented the successful utilization of roommates to reliably confirm subjects' reports.

A recently performed experiment (Woolfolk, Carr-Kaffashan, & McNulty, 1976) has compared progressive relaxation to mediation training in the treatment of sleep disturbances. Fifty-four individuals with sleep disturbances, who responded to advertisements placed in the community newspapers, were mailed a set of seven daily sleep forms. The 32 individuals who reported a mean latency to sleep onset of 30 minutes or more for this pretest week were randomly assigned within severity blocks to one of three conditions: meditation, progressive relaxation, or waiting-list control. Treatments were given in two small groups per condition during four weekly one-hour sessions. Subjects in the control group were informed that they had been placed on a waiting list and that it would be necessary for them to keep records of their sleep patterns for another four weeks. Posttest results indicated that both treatment groups showed significant superiority over the waiting-list control group on the dependent measures, latency to sleep onset and difficulty falling asleep. There were also no differences between the two treatment groups on any of the dependent measures. Results from a six-month follow-up conducted by having subjects fill out a week of daily sleep forms indicated

significant differences between pretreatment and follow-up on latency to sleep onset for both treatment groups. The authors discuss their findings in terms of support for the successful utilization of attention-focusing procedures to facilitate sleep onset in individuals with sleep disturbances. From the previously presented studies which have used relaxation training as therapy for sleep disturbances it would appear that this technique is quite effective in reducing latency to sleep onset.

Stimulus Control Treatments of Sleep Disturbances

A technique developed by Bootzin (1972) utilizes stimulus-control procedures for the treatment of sleep disturbances. Stimulus-control procedures are based on conditioned associations or cues which compete with falling asleep. More specifically, control must be developed with regard to those stimuli which are currently in the subject's environment and are maintaining sleep disturbances. In order to separate cues primarily associated with falling asleep from those for competing activities, Bootzin (1972, 1973) gave his subjects the following instructions: (a) go to bed only when sleepy; (b) do not read, watch television, or eat in bed; (c) if unable to fall asleep after 10 minutes, get out of bed and do something--then when sleepy return to bed (if still unable to sleep repeat as often as necessary); (d) get up each morning at the same time; and (e) do not take naps.

Bootzin (1972) first used this technique in a case study with a 25-year-old male who reported that he had had difficulty falling asleep during the previous four or five years. The client would attempt to fall asleep at midnight, but would be unable to fall asleep until three or four a.m. on most nights. The client was instructed to follow the above therapy instructions. Initially the client reported having to get out of bed and leave the room about four or five times a night. At the end of two weeks the client reported that he was getting out of bed only once a night on about half the nights out of the week. By the end of the follow-up period (seven weeks), the client reported getting up only once a night on one night a week. He also reported that he was getting two to four hours more sleep per night and having very little difficulty getting to sleep. The treatment seems to have been quite effective; however, its effectiveness may have been due to factors other than stimulus control (e.g., therapist contact, therapist demand characteristics, etc.).

Bootzin (1973) then did a controlled experiment in order to demonstrate that stimulus control techniques could produce reductions in latency to sleep onset. The four treatment conditions were: stimulus control, progressive relaxation training, self-relaxation, and no treatment. The self-relaxation procedure was similar to the one used by Nicassio and Bootzin (1974). There were 18 stimulus-control

and 18 self-relaxation subjects, 28 progressive-relaxation subjects, and 14 no-treatment subjects. After baseline recording of seven days, all subjects were seen once a week for four weeks.

Before treatment started, subjects were averaging over 90 minutes a night to fall asleep and were sleeping 5.5 hours a night. From the baseline week to the last week of treatment, stimulus-control subjects improved an average of 74 minutes as compared to improvement of 38, 15, and 24 minutes for progressive-relaxation, self-relaxation and no-treatment subjects respectively. At the end of treatment, subjects receiving either stimulus-control instructions or progressive-relaxation training were falling asleep significantly faster ($p < .05$) than subjects in the control group; in addition, subjects receiving stimulus-control instructions were falling asleep significantly faster than subjects who received progressive-relaxation training ($p < .01$). Sixty-one percent of subjects receiving stimulus-control therapy were averaging less than 20 minutes a night to fall asleep during the last week of treatment as compared to 14%, 28%, and 7% for subjects receiving progressive relaxation, self-relaxation and no treatment, respectively.

In summary, stimulus-control instructions were very effective in reducing sleep disturbances across measures of time to fall asleep, number of hours slept, and feeling good upon awakening. Relaxation training produced some improvement, but did not match the degree of effectiveness produced by stimulus control.

A replication of Bootzin's (1972) stimulus control treatment for sleep disturbances was performed by Price, Simons, and Haynes (1974). They used a single-subject, A-B-A-B reversal design with four subjects (two male, two female). All subjects were given an initial interview to assess the severity of their sleep problems. Then, each subject began a two-week baseline in which he or she filled out daily sleep forms. At the end of the second baseline week, the latencies to sleep onset for the four subjects were: 75, 78, 26, and 41 minutes, respectively. Following the baseline self-observation phase, subjects met with a therapist for weekly 30-minute sessions in which the principles of stimulus-control and specific procedures were outlined, following Bootzin (1972).

The first stimulus-control phase was maintained until stability of sleep behavior was reported (five consecutive days of little or no variation of the dependent measures). The reversal phase was then instituted: weekly sessions continued, but the subjects were instructed to reinstitute their pretreatment patterns of sleep-incompatible behaviors. The reversal phase continued until a clear trend toward baseline level was demonstrated or no trend was evidenced. Stimulus-control procedures were then reintroduced, and subjects were contacted by phone for a five-month follow-up. The results indicated that two subjects failed to demonstrate reversal of sleep behaviors toward baseline levels when the

stimulus-control procedures were discontinued during the reversal phase of the program. The latencies to sleep onset at follow-up were: 22, 10. 7.5, and 12.5 minutes, respectively.

It appears that the subjects did improve their latencies to sleep onset; however, since two subjects failed to demonstrate reversal trends there is a question about the internal validity (Campbell & Stanley, 1966). Thus, these findings should be evaluated with caution concerning the specific contribution of the stimulus control procedures.

A study was performed by Tokarz and Lawrence (1974) to analyze the temporal and stimulus factors in the treatment of sleep disturbances. Fifty college subjects who reported latencies to sleep onset of 30 minutes or greater on three or more days of the week were initially selected from an introductory psychology class and then asked to fill out a week of baseline sleep forms. By use of these baseline results, the subjects who at this point did not meet the criterion were screened out. The remaining subjects were blocked on their average latencies to sleep onset and randomly assigned to one of five therapy conditions: stimulus control, temporal control, combined (stimulus and temporal conditions), self-relaxation (placebo), and delayed treatment.

The stimulus-control condition was comprised of the following procedural steps: (a) go to bed only when sleepy; (b) do not read, watch television, or eat in bed; (c) if you

find yourself unable to fall asleep after 10 minutes, get up immediately and go do something else; if you still cannot fall asleep within 10 minutes repeat this procedure as often as necessary. The temporal-control condition was comprised of the following procedural steps: (a) go to bed at a fixed hour every night, (b) set your alarm and get up at the same time every morning irrespective of how much sleep you got during the night, (c) do not nap during the day. The combined treatment was composed of all the steps in both the temporal and stimulus control conditions. The step of going to bed only when sleepy was combined with the step which asked subjects to go to bed at a fixed hour every night, in that subjects were told to go to bed within a fixed hour every night, but only when sleepy sometime during that hour. The self-relaxation (placebo) condition was identical to the one used by Nicassio and Bootzin (1974). The delayed-treatment subjects were merely told that therapy was being done in two waves and that they had been randomly selected to receive treatment in the second wave of therapy, which was five weeks away.

Subjects were seen individually during four brief therapy sessions over four weeks. Fifty-one percent of all the subjects had roommates performing 10 reliability checks over the course of the study on six of the dependent measures in a manner described by Tokarz (1974). Approximately 72% of all reliabilities were .97 or better, with no reliability

being lower than .91. The combined condition, the stimulus-control condition, and the temporal-control condition all produced significantly greater improvement in reported latency to sleep onset and in all other dependent measures as compared to the two control conditions at the first (two-week) follow-up and the second (five-month) follow-up.

An interesting finding in the results was that the stimulus-control subjects were going to bed later than the temporal or combined subjects and also later than the two control groups by the last therapy week. The temporal and combined groups were not significantly different from each other or the two control groups on the measure of lateness to bed by the last therapy week. The stimulus-control subjects were also getting less sleep than the temporal or combined subjects, yet significantly more sleep than either of the two control groups. This fact implies that stimulus-control procedures may be operating by a sleep-deprivation mechanism. The sleep-deprivation mechanism would function in the case of subjects who on a preceding night had a reduced amount of sleep (i.e., 5 hours) and then during the subsequent night got to sleep with a short latency, presumably due to the fact that they were sleep-deprived and therefore, more tired. Another logical direction which this study implies is a formal experimental comparison of relaxation training and stimulus control in order to replicate Bootzin's (1972) findings.

Lawrence, Tokarz, and Hussian (1975) performed a study comparing relaxation training and stimulus control. There was also a placebo-control group in this study. The relaxation training was taken specifically from Bernstein and Borkovec's (1973) relaxation manual. The stimulus-control procedure was the combined treatment procedure as used in the Tokarz and Lawrence (1974) study. The placebo control was identical to the one used by Borkovec et al. (1974) and consisted of determining with each subject his or her pre-bedtime events or hierarchy items and pairing these imaginally with neutral items in a pseudo-desensitization manner. The subjects were selected and assigned in the same manner as in the Tokarz and Lawrence (1974) study, except that the minimum average latency to sleep onset was set at 60 minutes. The subjects received either four group or four individual treatments lasting approximately 30 minutes over four weeks. Reliability measures were performed in the same manner as used in the Tokarz (1974) and Tokarz and Lawrence (1974) studies.

Results indicate that the stimulus-control subjects were superior to the subjects in either the relaxation or placebo condition with regard to reducing their latencies to sleep onset. This study represents experimental support for Bootzin's (1972) contention that "stimulus-control techniques are superior to relaxation-training techniques in reducing latency to sleep onset."

Now that current research on sleep disturbances has been reviewed, a theoretical elaboration dealing with the rationale for the current study will be offered. Bootzin (1973) demonstrated that stimulus control was superior to relaxation training in reducing the latency to sleep onset with subjects suffering from sleep disturbances. Lawrence, Tokarz, and Hussian (1975) also report results which show stimulus control procedures to be superior to relaxation training in reducing latency to sleep onset. Thus, there would appear to be some support for the contention that stimulus-control techniques are more effective in treating sleep disturbances than relaxation techniques. Further replications will be necessary to conclusively demonstrate stimulus control's superiority over relaxation training in the treatment of sleep disturbances; however, if it can be assumed that stimulus-control techniques are in fact as effective as Bootzin (1973) and Lawrence, Tokarz, and Hussian (1975) have claimed, then the mechanism by which these produce such change should be investigated and isolated if possible.

It is important to determine the factors which lead to the effectiveness of stimulus control because certain components of stimulus control might be differentially more important than others, with some actually being redundant. Therefore, when the relevant, efficacious factors are isolated, clinicians can stress these factors to clients while putting less emphasis on the other, less relevant factors.

Tokarz and Lawrence (1974) attempted to analyze the temporal and stimulus factors in the stimulus-control treatment of sleep disturbances. An interesting finding in their results was that by the last therapy week the stimulus-control subjects were going to bed later than the temporal or combined subjects. The stimulus-control subjects were also getting less sleep than the temporal or combined subjects, yet significantly more sleep than either of the two control groups. This finding implies that stimulus-control procedures may be operating by virtue of sleep-deprivation factors. Thus, it would appear to be important to investigate the relationship between the amount of sleep each night and latency to sleep onset.

In the present study, the sleep-deprivation factor was investigated by using two conditions. In one condition, the subjects were instructed to get approximately seven hours of sleep a night (high sleep deprivation, or reduced sleep allocation), and in the other condition subjects were instructed to get approximately nine hours of sleep a night (low sleep deprivation, or increased sleep allocation). By manipulating this independent variable of sleep deprivation, it was possible to assess the relative contribution of this factor to the efficacy of stimulus-control procedures.

Another factor in the stimulus-control procedure which would appear to be of importance is the nature of what is done by the subject when he or she cannot fall asleep after

10 minutes and gets out of bed. More specifically, does the subject once out of bed engage in a task which is pleasurable, or one that is unpleasant? Bootzin (1972) feels that the single act of getting out of bed is aversive, which is most likely true; but, the issue of what happens once the subject is out of bed may be of even more importance. In all past studies using stimulus-control procedures, no attempt has been made by experimenters to assess what subjects have been doing once they get out of bed. Thus, in order to isolate the specific factors which cause stimulus control to be effective, the nature of tasks performed by subjects in the current study was specified and controlled.

One group of subjects in the unpleasant-pleasant conditions of the current study was asked prior to the initiation of therapy to list three behaviors which were pleasant to them and which could be performed in their homes or rooms without the aid of other individuals. Another group of subjects was asked to list three behaviors which were highly unpleasant to them and which also could be performed in their homes or rooms without the aid of other individuals. The rationale for having subjects choose unpleasant behaviors would revolve around the principle that behavior is a function of its consequences, and if not falling asleep and getting out of bed is followed by an unpleasant behavior then it is hypothesized that not falling asleep and getting out of bed should decrease in its occurrence. Conversely,

pleasant behaviors were utilized to determine whether not falling asleep and getting out of bed would increase in their occurrence if followed by a pleasant behavior.

Subjects in the pleasant condition were also asked to perform their most pleasant behavior when they got out of bed, and when this behavior failed to be pleasant to perform the second most pleasant behavior; likewise, when this activity lost its pleasant quality, they were to perform the third most pleasant behavior. They were instructed to continue varying the three behaviors, so that they maintained highly pleasant levels. In the unpleasant condition, the same strategy regarding maintaining high affective levels was used with regard to the unpleasant behaviors.

This method of allowing subjects to choose their own particular pleasant and unpleasant events was used rather than having subjects engage in experimenter-selected events, because the personal selection of events by each subject more closely tailors the technique to each subject. The importance of manipulating this independent variable of unpleasant-pleasant behaviors was that it resulted in a more precise specification of the stimulus-control procedure. Not only could one of the effective factors of the stimulus-control method be isolated, but clinicians would also be provided with further information, so that they could utilize stimulus-control techniques more effectively for each client.

An additional condition was included in this study in order to assess the effects of subjects performing a neutral task once they got out of bed. This condition was necessary to demonstrate that either the unpleasant or pleasant event would produce a change above and beyond just getting out of bed. It could very well be possible that the unpleasant or pleasant events selected by subjects were not significantly different from neutral events; therefore, this is an important control condition to use as a comparison with the results from the unpleasant-pleasant conditions. The subjects in the neutral condition were instructed to perform an event which was neutral to them (i.e., not particularly pleasant or unpleasant) when they got out of bed.

The final condition in this study was a self-relaxation placebo-control group identical to the one used by Nicassio and Bootzin (1974). This control condition has been previously demonstrated to be a high-expectation control group (Tokarz & Lawrence, 1974). This condition was to control for various demand characteristics (Orne, 1962), therapist contact, performing any technique regularly, etc. The subjects in this condition were told that the major factor causing their sleep difficulty was that they did not relax themselves frequently enough. They were told that everyone knows how to relax and it is just a matter of setting a specific time aside each day to relax. No relaxation instructions were provided to the subjects in the delayed treatment group.

Two additional techniques were utilized in the current study. One was the enlisting of subjects' roommates (when possible) to perform reliability checks (Tokarz, 1974; Tokarz & Lawrence, 1974; Lawrence, Tokarz, & Hussian, 1975) on the various dependent measures taken by the subjects. Thoresen and Mahoney (1974) indicate that self-report data cannot be automatically assumed to be accurate and that it should be the experimenter's responsibility to develop a method to empirically demonstrate the accuracy of self-reports.

Another concern of Thoresen and Mahoney (1974) is that it makes little difference if some therapeutic technique would be effective if implemented, when such implementation is either non-existent or not evaluated; therefore, roommates in this study were asked to take reliability measures on the various independent measures used. The use of this technique would provide more substantiation than merely assuming that the therapy techniques were being performed. It was hoped that the utilization of reliability techniques in this study would help make the experiment more precise and lead to more definitive conclusions.

In summary, two independent variables were manipulated in the study: sleep deprivation and unpleasant-pleasant factors. These two independent variables were manipulated in order to determine their relative contributions with regard to the therapeutic success of the stimulus-control procedure.

The dependent measures were latency to sleep onset, number of awakenings during the night, subjective difficulty getting to sleep, subjective feelings of restedness upon awakening, number of times out of bed before asleep, number of times out of bed for each day out of bed, number of days per week out of bed, average number of minutes out of bed, and amount of sleep. Roommates were utilized to provide reliability estimates on the time to bed, time to sleep, time up in the morning, number of awakenings during the night, and the frequency with which subjects got out of bed prior to falling asleep.

CHAPTER II

METHOD

Experimental Design

The basic design was a 3 x 2 x 7: three behaviors (unpleasant, pleasant, and neutral) x two levels of sleep deprivation (seven and nine hours of sleep) x seven temporal phases (baseline, treatment weeks one, two, three, four, five, and follow-up). In addition there was a self-relaxation placebo-control group.

Subjects

Male and female college students were selected from several introductory psychology classes, employing screening forms, in such a way that their average latency to sleep onset was 60 minutes or greater for three or more days out of the week. The subjects were then asked to come in for interviews in which they filled out a general sleep-history questionnaire and were questioned to insure that the cause of their sleep disturbances was not external noise in their environment. They were also asked if they believed that their roommates would be willing to help out with the study. If a student said that his or her roommate would be willing to cooperate, then he or she was given a packet for the roommate and told that he or she would be called that day and given instructions. The roommate packet contained explanation forms

regarding the roommate's role in the study and data collecting forms for 12 observations. The roommates were called immediately following the subjects' interviews, asked if they would be willing to participate, and cautioned against disclosing any information to the subject. Twelve days of observations were then agreed upon with the roommate so that two observations would occur during each of the six weeks. In the initial interview subjects were also given a packet of seven daily sleep questionnaires which they were asked to fill out each morning during the following week. Subjects were also informed that they would receive research credit for their participation in the experiment.

Treatment Sessions

Subjects returned the baseline forms at the end of a week and were told that they would be contacted for therapy appointments shortly. Averages of latency to sleep onset for the baseline week were computed for each subject, and subjects who did not have averages which were 60 minutes or greater for the week of baseline were given research credit and told that they did not meet the requirements for the study, yet would still be offered therapy outside the experiment. Those subjects who met the criteria had their latency scores rank-ordered and blocked, and then the seven treatments were randomly assigned to the scores in each block (see Boneau & Pennypacker, 1961). Clients were seen individually for

30 minutes on the first session and then seven minutes on each of the subsequent four sessions during five weeks, with one therapy session per client per week. A minimum of six clients were selected for each therapy condition.

Therapist

A fourth-year graduate student with a Master of Arts degree and experience in conducting three previous studies on sleep disturbances served as the therapist. He followed detailed therapy manuals during all treatment sesions.

Treatment Groups

Subjects in all active treatment conditions were given the following procedural steps: (a) go to bed only when sleepy, (b) do not watch television, read, or eat in bed, (c) do not nap during the day. Subjects in the high sleep-deprivation conditions (7 hours of sleep) were given the additional procedural step: (d) set your alarm clock so that you are sure to get a minimum of seven hours of sleep a night and usually not more than seven hours of sleep. Subjects in the low sleep-deprivation conditions were given the additional procedural step: (d) set your alarm clock so that you are sure to get a minimum of nine hours of sleep a night and usually not more than nine hours of sleep. Subjects in the pleasant(unpleasant)-behavior conditions were given the following procedural steps: (e) if you find yourself unable to fall asleep after 10 minutes, get up immediately and do one of the

three behaviors which you have selected to be most pleasant (unpleasant); continue doing this behavior for as long as you stay up; when you feel sleepy return to bed; if you still cannot fall asleep within 10 minutes repeat this procedure as often as necessary; (f) if and when the pleasant(unpleasant) behavior that you are presently performing ceases to be pleasant(unpleasant), switch to another of the three behaviors which is more pleasant(unpleasant); keep switching the behaviors so that their pleasantness(unpleasantness) is maintained; remember it is important to always select the most pleasant(unpleasant) of the three behaviors. Subjects in the neutral conditions were given the following procedural steps: (e) if you find yourself unable to fall asleep after 10 minutes, get up immediately and do one of the three behaviors that you have selected to be most neutral to you, meaning that neutral behavior which is neither pleasant nor aversive; continue doing this neutral behavior for as long as you stay up; when you feel sleepy return to bed; if you still cannot fall asleep within 10 minutes repeat this procedure as often as necessary; (f) when the neutral behavior you are doing ceases to be neutral, switch to another of the three which is more neutral; keep switching the behaviors so that their neutral quality is maintained; remember, it is important to always select the most neutral of the three behaviors.

Subjects in all active treatment conditions were presented with the following general stimulus-control rationale:

> The reason for going to bed only when sleepy is that many clinical studies have shown that people with

> sleep difficulties usually go to bed when they are not really sleepy and thus lie in bed for long periods of time rehashing the day's events in their minds, tossing and turning until they become tired and eventually fall asleep. The reason for not reading, watching television, or eating in bed is that when these activities are performed in bed they will become associated with bed and bed-time, thereby making it more difficult to get to sleep when you are thinking of these activities, rather than when you are just thinking of bed and falling asleep. Clinical studies have also found that people with insomnia usually tend to lie in their beds when they cannot sleep and toss and turn or rehash the day's events or worry and get hot, irritable, and generally pretty uncomfortable. Thus, by lying in bed on numerous occasions and experiencing these aversive consequences, bed and bedtime tend to take on unpleasant qualities for the insomniac.
>
> The end result is that bed and bed-time become associated with not falling asleep quickly and the negative aspects result from this. Thus, by getting out of bed if you are unable to fall asleep in 10 minutes, you will come to associate your bed with falling asleep quickly, and bed, and bedtime will come to take on positive features. It is important to refrain from napping during the day because this upsets the body's natural circadian rhythm. This circadian rhythm controls when you are awake and asleep; thus if you disturb this by taking naps the body becomes confused as to when rest should occur. The body mistakes these naps for actual sleep and then you have insomnia.

Subjects in the high sleep-deprivation conditions were given the following additional rationale:

> The reason for getting a maximum of seven hours of sleep a night is that clinical studies have shown since people with insomnia take so long to get to sleep, that they usually compensate for this by sleeping more than seven hours a night. Further studies have proven that any more than seven hours of sleep a night makes a person feel tired, lethargic, and sluggish the next day. More than seven hours of sleep also makes it harder to get to sleep the next night than if a person has seven or less hours of sleep, because this slight sleep deprivation produces a state in the body which facilitates getting to sleep.

Subjects in the low sleep-deprivation conditions were given the following additional rationale:

> The reason why you should get nine hours of sleep is that studies have shown that most people with insomnia do not get enough sleep and usually sleep less than nine hours a night. As a result of this lack of sleep, these people find themselves overtired when it comes time to go to sleep at night and this is one of the reasons they stay awake so long.

Subjects in the unpleasant-behavior conditions were given the following additional rationale:

> Once you are out of bed it is important to do something that is unpleasant because clinical research has found that when unpleasant things follow something else, the thing they follow will not be done as often. In this case, if you do something unpleasant when you cannot fall asleep and you get out of bed, then doing this aversive thing should cause you in the future to get out of bed less and fall asleep sooner.

Subjects in the pleasant-behavior conditions were given the following additional rationale:

> The reason for performing a pleasant task when you cannot sleep after 10 minutes and have gotten out of bed, is that it helps you to become more at ease, less tense, and counteracts the negative feelings which have been associated with staying awake. Thus, by performing a pleasant task the body begins to gradually relax and the natural sleep mechanisms which have been inhibited by the negative feelings of staying awake begin to be released and you gradually get to sleep sooner.

Subjects in the neutral conditions were given the following additional rationale:

> The reason for performing a behavior that is neutral when you cannot sleep and get out of bed is that performing a neutral behavior will not emotionally excite you like a pleasurable or unpleasant behavior could. Therefore, it is important to perform a behavior which is neutral so that your body will remain calm, at ease and not be excited. In this way when the performing of this neutral behavior calms your body you will be able to get sleepy and go back to bed and sleep more quickly than if you performed a behavior which excited you (either pleasantly or unpleasantly).

The subjects in the self-relaxation (placebo-control) condition received the same procedures as used by Nicassio and Bootzin (1974).

> The subjects in this condition were told that most people have daily tensions and tightness which readily produce sleep disturbances. Most people have such busy schedules that they very seldom have time to relax themselves. Studies have been performed in self-relaxation which demonstrate that by relaxing yourself a person can reduce his blood pressure and heart rate and basal metabolism. Thus self-relaxation can produce physiological relaxation which will lead to sleep in a short time. Researchers have found that the remedy for sleep disturbances is for the individual with sleep problems to allot daily periods of time specifically to self-relaxation. Thus, what you will have to do is allot yourself 20 minutes each day preferably after lunch or after your classes and then self-relax. It is important that you do not practice self-relaxation at night because by that point your body has reached a level of tension which is almost impossible to dissipate. Now in regards to the actual practice of self-relaxation, it is entirely dependent upon each individual how they will choose to do it. After all, we are all different in our previous learning histories and what may make one person relaxed may make another person more tense; therefore, you should relax yourself by whatever method that you have used in the past. I also want you to practice your self-relaxation while sitting in a chair or on the floor each day for 10 minutes. The reason for sitting up is that psychophysiologists tell us that the body is better able to synchronize brain patterns with sensations from the limbs of the body by sitting rather than lying down.

Ethical Considerations during Therapy

During the course of the study subjects recorded on their daily sleep questionnaires any difficulties which related to their sleep problems (e.g., doing poorly in class, negative effects on social interactions, and excessive irritability). These responses were continuously monitored throughout therapy for all groups, and if any therapy

technique interfered with these activities the subject was to be dropped from the study. No subject had to be dropped during the course of the study due to any of the above reasons.

Dependent Measures

Data taken by subjects. During the one week of baseline, five weeks of therapy, and one week of follow-up, subjects were asked to fill out daily sleep questionnaires each morning before leaving their rooms. These forms assessed via non-global, specific, written reports, the following measures: what time subjects first got into bed; how many times they got out of bed before they fell asleep; how long they were out of bed before they fell asleep; the time of the last instance in which they got into bed and did not get out again until they fell asleep; what time they fell asleep; how much difficulty they had in falling asleep (rating on a 1 to 5 scale); how many times they awakened during the night; what time they got up in the morning; and finally how rested they felt upon awakening that morning (rating on a 1 to 4 scale). Also included on the daily sleep forms were notations of the behaviors that the subjects in the six active treatment groups performed on nights that they had to get out of bed.

Data taken by roommates. Roommates were asked to observe the subjects as inconspicuously as possible and to record the following aspects of each subject's sleep behavior: the time of the first instance that the subject got into

bed to go to sleep; how many times the subject got out of bed once he or she had gotten in to go to sleep; the time of the last instance in which the subject got into bed and did not get out until he or she was asleep; the time he or she got to sleep; if the roommate was aware of the subject awakening during the night, how many times; and finally if the roommate was there and awake, what time the subject got up in the morning. The following criteria were given to the roommate in order for him or her to determine when the subject was asleep: (a) eyes must be closed, (b) no voluntary movements for at least 10 minutes, (c) a deeper breathing rate than normal ("just notice if your roommate appears to be breathing with deeper, slower breaths than during a waking state"). Finally, (d) "when you find that your roommate meets the three preceding criteria, you should whisper (and it is important that you do this as quietly as possible and only when you have observed the three previous criteria and are reasonably sure he or she is asleep) very softly, 'Are you asleep?' Of course if your roommate does not respond, then you should immediately note the time and enter it on your data sheet."

The roommates were also told by phone what behaviors (pleasant, unpleasant, or neutral) the subject would be performing depending upon his or her therapy condition, and the particular behaviors selected. Roommates were then asked to note down on their reliability sheets if they were aware of

the subject performing these specific behaviors during 12 days (two observations per week during all six phases except baseline). Roommates were instructed to place all completed data in an envelope at the end of the last therapy week and return the data via campus mail.

Procedure

A presentation of the rationale and a therapeutic contract was provided to subjects during the first interview. The therapist contract was non-monetary and merely stated the subject's obligations in the study (i.e., attend all treatment sessions, notify therapist regarding cancellation, etc.) and those of the therapist (i.e., provide the therapy procedures to the subject as well as possible and give feedback when the study is completed). Subject and therapist both signed the contract and the subject retained it. This procedure attempted to improve the commitment of the subject to complete the entire therapeutic program.

All subjects at the end of the initial session were asked to recite, in outline form, the main aspects of their therapy procedure. Subjects were given a treatment outline (after they had repeated the main points) which had all the steps of their specific procedures outlined on it. These two manipulations were done to eliminate misinterpretation and ambiguities which might arise.

Subjects were also asked during this first session to select their unpleasant, pleasant, or neutral behaviors (if

they were in the appropriate groups), and the experimenter wrote these down. Subjects were asked in the unpleasant condition to name three behaviors which were highly unpleasant and which could be performed in their own home or room without the need for other individuals. The subjects in the pleasant condition were asked to use the same parameters except that the three behaviors picked were to be highly pleasurable. Subjects in the neutral group selected three neutral behaviors in a similar manner.

Prior to starting the study the therapeutic rationale for each of the seven therapy conditions (high sleep-deprivation, unpleasant; low sleep deprivation, unpleasant; high sleep-deprivation, pleasant; low sleep-deprivation, pleasant; high sleep-deprivation, neutral; low sleep-deprivation, neutral; self-relaxation, placebo control) was rated on the logic and probability of therapeutic effectiveness, by 14 students from Psychology 505 at the University of North Carolina at Greensboro.

At the conclusion of the first session all subjects were asked to rate on two 10-point scales the logic of, and expectancy of ultimate improvement generated by, the rationale and procedures just described (Borkovec et al., 1974). During the first session subjects were also asked to rate their level of motivation (with regard to reducing their times to fall asleep) on a 10-point scale.

During the subsequent four therapy sessions therapeutic procedures were reviewed, and subjects were given the opportunity

to discuss with the therapist any problems they might have regarding implementation of their therapy procedure, and a review of the past week's sleep forms was also included. Subjects in all active treatment conditions were prompted by the therapist during the therapy sessions to make sure that they were getting the prescribed amount of sleep. At the last therapy session subjects in the active treatment groups were asked to rank-order the various aspects of their treatment procedure from most to least effective in regards to amelioration of their sleep difficulties.

The follow-up was conducted three weeks from the last therapy session; all subjects were asked to fill out daily sleep forms (which they were given at their last therapy appointment), and then these forms were sent in by campus mail. This was the first follow-up; the second follow-up was identical to the first except it took place six months from the last therapy session. The second follow-up was not included in the analysis because the data was obtained after the study was written up. All subjects received a debriefing on the experiment after the second follow-up was completed. Placebo subjects were also offered the stimulus control treatment subsequent to the debriefing.

CHAPTER III

RESULTS

During the first week of the study only one subject elected not to continue, for reasons unrelated to the experiment. That left six subjects in the high-deprivation, neutral group and seven subjects in each of the remaining six groups.

Independent Therapy Ratings

Fourteen students from Psychology 505 (Behavioral Principles) at the University of North Carolina at Greensboro were given written descriptions of all seven therapy conditions. They were then asked to rate each treatment on two 10-point scales, telling how logical each of the seven treatment descriptions sounded and how therapeutically effective each would be.

Two one-way ANOVAs were performed to assess if there were any differences between how the treatment groups were rated on the two 10-point scales. The first one-way ANOVA, summarized in Table 1, assessed the independent ratings of therapeutic effectiveness. As can be seen, there were no significant effects; therefore, it can be assumed that no therapy was rated as either being more or less therapeutically effective than any other therapy condition at the beginning of the study.

TABLE 1

A One-Way ANOVA on Independent Ratings of Therapeutic Effectiveness

Source	df	MS	F
Treatments	6	6.66	.75
Error	91	7.45	

The second one-way ANOVA, summarized in Table 2, assessed the independent ratings of the therapy logic. As can be seen, there were again no significant effects; therefore, it can again be assumed that no therapy condition was rated as either appearing more or less therapeutically logical than any other therapy condition.

Subject Ratings of Motivation and Therapy Procedures

Subjects in all treatment groups were asked to rate their degree of motivation to improve their sleep patterns on a 10-point scale during the first treatment session. A one-way ANOVA was performed on these motivation ratings to determine if there were significant differences in levels of motivation between the seven therapy groups. The results of this one-way ANOVA on motivation ratings are summarized in Table 3 and reveal that there were no significant effects. It can be concluded that there were no therapy groups in which the subjects were especially motivated to change their behavior at the beginning of therapy.

At the end of the first treatment session subjects in all seven treatment groups were also asked to rate on a 10-point scale how therapeutically effective they believed the therapy just explained would be. A one-way ANOVA was performed on these effectiveness ratings in order to assess if there were significant differences in perceived effectiveness among the seven therapy groups. The results of

TABLE 2

A One-Way ANOVA on Independent Ratings of Logic

Source	df	MS	F
Treatments	6	8.74	1.13
Error	91	7.68	

TABLE 3

A One-Way ANOVA on Subject Ratings of Motivation

Source	df	MS	F
Treatments	6	1.95	.61
Error	41	3.17	

this one-way ANOVA on ratings of therapeutic effectiveness are summarized in Table 4 and again reveal that there were no significant effects. It can be concluded that no therapy condition was rated by the subjects as being significantly more or less therapeutically effective than other therapy conditions at the beginning of therapy.

Finally, at the end of the first treatment session subjects in all treatment groups were asked to rate on a 10-point scale how logical they believed the therapy explained was. A one-way ANOVA was performed on these logic ratings in order to assess if there were significant differences in perceived logic among the seven therapy conditions. The results of this one-way ANOVA on ratings of therapy logic are summarized in Table 5 and reveal that there were no significant effects. Paralleling the results for motivation and perceived effectiveness, there were no therapy conditions which the subjects rated as being more or less logical than any other therapy conditions at the beginning of the study.

Subject-Roommate Reliability Data

Fifty-four percent (N=26) of the subjects had roommates taking reliability checks. The breakdown of subjects with roommates taking reliability in each group was as follows: high sleep-deprivation, unpleasant--5; low sleep-deprivation, unpleasant--4; high sleep-deprivation, pleasant--3; low sleep-deprivation, pleasant--5; high sleep-deprivation, neutral--4;

TABLE 4

A One-Way ANOVA on Subject Ratings of Therapeutic Effectiveness

Source	df	MS	F
Treatments	6	1.42	1.05
Error	41	1.34	

TABLE 5

A One-Way ANOVA on Subject Ratings of Therapy Logic

Source	df	MS	F
Treatments	6	.37	.31
Error	41	1.21	

low sleep-deprivation, neutral--2; and placebo-control--3. The Pearson product-moment correlation coefficients presented in Table 6 were computed for time to bed, times out of bed prior to sleep, time to sleep, times awakened, and time up, and were averaged across all seven groups and across all treatment phases of the study to provide reliability measures. The reliability coefficients presented in Table 6 ranged from .83 to .99, and all were significant at $p < .001$. Reliability was also examined for the different experimental groups and treatment phases. The reliability measures in Table 7 are reported for each experimental group and averaged across all treatment phases of the study. The reliability coefficients presented in Table 7 ranged from .63 to 1.0, with 89 percent of the reliability coefficients being .82 or greater. All reliability coefficients in Table 7 were significant at $p < .001$. The reliability measures in Table 8 are reported for each of the six phases (treatment week one to follow-up) and averaged across all seven groups. The reliability coefficients presented in Table 8 ranged from .71 to .99, with 93 percent of the reliability coefficients being .82 or greater. All reliability coefficients in Table 8 were significant at $p < .001$.

Reliability for each of the three behaviors (pleasant, unpleasant, and neutral) performed by the subjects in each of the six treatment groups was assessed by percent agreement $\left(\frac{\text{number of agreements}}{\text{number of agreements + number of disagreements}}\right)$ of roommate with subject's reports. In Table 9 these percent agreement

TABLE 6

Reliability Correlation Coefficients of Roommate with Subject Reports for the Entire Study

Time to Bed	Times out of Bed	Time to Sleep	Times Awakened	Time Up
.99	.91	.99	.83	.98

$p < .001$ for all coefficients

$n = 312$ for all coefficients

TABLE 7

Reliability Correlation Coefficients of Roommate with Subject Reports as a Function of the Seven Groups for the Entire Study

Treatment Group	Time to Bed	Times out of Bed	Time to Sleep	Times Awakened	Time Up
High Deprivation Unpleasant n=60	.98	.94	.99	.88	.98
Low Deprivation Unpleasant n=48	.94	.92	.98	.63	.96
High Deprivation Pleasant n=36	.96	.93	.95	.82	.99
Low Deprivation Pleasant n=60	.99	.92	.99	.77	.98
High Deprivation Neutral n=48	.98	.75	.99	.91	.98
Low Deprivation Neutral n=24	.98	.89	.99	1.00	.99
Self Relaxation Placebo Control n=36	.99	1.00	.98	.67	.97

$p < .001$ for all cells

TABLE 8

Reliability Correlation Coefficients of Roommate with Subject Reports as a Function of Each of the Six Phases: Treatment Week 1 to Follow-up for All Seven Groups

Treatment Phase	Time to Bed	Times out of Bed	Time to Sleep	Times Awakened	Time Up
Treatment Week 1 n= 52	.99	.95	.99	.82	.99
Treatment Week 2 n=52	.99	.90	.98	.86	.98
Treatment Week 3 n=52	.98	.89	.99	.89	.99
Treatment Week 4 n=52	.99	.90	.99	.71	.97
Treatment Week 5 n=52	.98	.84	.99	.86	.98
Follow-up Week n=52	.99	.95	.98	.76	.98

$p < .001$ for all cells

reliabilities are reported for each experimental group and averaged across all treatment phases of the study. The percent agreements reported in Table 9 ranged from 92 to 98. In Table 10 the reliability by percent agreement for all of the three behaviors (pleasant, unpleasant, and neutral) performed by subjects are reported as averaged across all six treatment groups and as a function of the six phases: treatment week one to follow-up. The reliability figures in Table 10 ranged from 91% to 98%. In summary, the reliabilities reported in Tables 6 to 10 are all sufficiently high and lend support to the premise that the roommate and subject reports have high agreement.

Analysis of Pretreatment Effects

A one-way, seven-treatment-groups, multivariate ANOVA was performed on the nine dependent measures (latency to sleep onset, number of times out of bed before asleep, degree of restedness, number of times awakened, difficulty getting to sleep, number of times out of bed on each day out of bed, number of days per week out of bed, average number of minutes out of bed, and amount of time slept) at baseline in order to determine if there were significant differences in any of the dependent measures between groups prior to initiating therapy. These multivariate ANOVA results are summarized in Table 11, and they reveal that there were no significant differences in the dependent measures between groups.

TABLE 9

Reliability Assessed by Percent Agreement of Roommate with Subject Reports for Each of the Three Behaviors (Pleasant, Unpleasant, and Neutral) Performed by the Subjects, as a Function of the Six Treatment Groups for the Entire Study

Treatment Group	Percent Agreement
High Deprivation - Unpleasant n=60	97
Low Deprivation - Unpleasant n=48	95
High Deprivation - Pleasant n=36	97
Low Deprivation - Pleasant n=60	97
High Deprivation - Neutral n=24	92
Low Deprivation - Neutral n=36	98

TABLE 10

Reliability Assessed by Percent Agreement of Roommate with Subject Reports for Each of the Three Behaviors (Pleasant, Unpleasant, and Neutral) Performed by the Subjects, as a Function of the Six Phases: Treatment Week 1 to Follow-up for All Six Groups

Treatment Week	Percent Agreement
Week 1 n=52	96
Week 2 n=52	91
Week 3 n=52	93
Week 4 n=52	91
Week 5 n=52	98
Follow-up Week n=52	98

TABLE 11

Baseline Multivariate Analysis of Variance on the Nine Dependent Variables: Latency to Sleep Onset, Number of Times out of Bed before Asleep, Degree of Restedness, Number of Times Awakened, the Difficulty Getting to Sleep, Number of Times out of Bed on Each Day out of Bed, Number of Days Per Week out of Bed, Average Number of Minutes out of Bed, and Amount of Time Slept.

Source	U-Statistic	df	Approximate F	df
Treatments	.265	6, 1, 16	.952	54, 172

Analysis of Treatment Effects

Two sets of analyses were performed on the data. One set involved a 3 x 2 x 7 (three different behaviors performed when out of bed x two levels of sleep deprivation x seven phases) multivariate ANOVA performed on the nine dependent measures (see below) and univariate analyses for each of the dependent variables. The purpose of the 3 x 2 x 7 analyses was to assess interactions between sleep deprivation levels and behaviors performed. Also interactions between the two independent variables and the seven phases of the study were assessed by the 3 x 2 x 7 analyses. Secondly, in order to compare the performance of the placebo-control group with the six active treatment conditions a 7 x 7 (7 treatment groups x 7 phases) multivariate ANOVA was performed on the nine dependent measures (see below), and univariate analyses were also performed on each dependent variable. An important function of these analyses, as with the 3 x 2 x 7 analyses, was to also attempt to assess the interaction of the various treatment groups at the seven phases.

Independent Variable Comparisons

The outcome of the 3 x 2 x 7 multivariate ANOVA using nine dependent measures (latency to sleep onset, number of times out of bed before asleep, degree of restedness, number of times awakened, difficulty getting to sleep, number of times out of bed on each day out of bed, number of days per week out of bed, average number of minutes out of bed, and

amount of sleep) is indicated in Table 12. Only the phase main effect was significant at the .01 level (F=11.48; df=54, 1034). These results indicate that there were significant differences among the various experimental phases across all combinations of the two independent variables (behaviors performed and sleep deprivation) with regard to an optimal combination of the above nine dependent measures. In order to assess more specifically where these significant differences were located, nine 3 x 2 x 7 (three behaviors performed x two levels of sleep deprivation x seven phases) ANOVAs were performed. Each 3 x 2 x 7 ANOVA utilized one of the nine dependent measures previously mentioned. Separate tables are presented for each dependent measure indicating an ANOVA summary and the treatment means for all groups. It should be noted that the placebo group was included in the main data tables for the 3 x 2 x 7 ANOVAs to avoid redundancy since it will be discussed in later analyses. A summary of the significant relationships found for each dependent measure in the 3 x 2 x 7 and 7 x 7 analyses is provided in Tables 35 and 46 which occur at the end of each respective analysis section.

The results of the dependent measure latency to sleep onset are presented in Table 13 and indicate a significant phase main effect at the .01 level (F=94.6; df-6,210). The treatment means for latency to sleep onset are presented in Table 14. Scheffe' post hoc tests indicated that the six

TABLE 12

Multivariate Analysis of Variance on the Nine Dependent Variables: Latency to Sleep Onset, Number of Times out of Bed before Asleep, Degree of Restedness, Number of Times Awakened, Difficulty Getting to Sleep, Number of Times out of Bed on Each Day out of Bed, Number of Days Per Week out of Bed, Average Number of Minutes out of Bed, and Amount of Sleep

Source	U-Statistic	df	Approximate F	df
Behaviors (A)	.399	2, 3, 13	1.45	18, 56
Sleep Deprivation (B)	.632	1, 4, 13	1.74	9, 27
Behaviors x Sleep Deprivation	.389	2, 3, 13	1.87	18, 56
Phases (C)	.091**	6, 1, 100	11.48**	54, 1034
Behaviors x Phases	.768	6, 1, 100	1.02	54, 1034
Sleep Deprivation x Phases	.579	9, 1, 100	1.09	108, 1483
Behaviors x Sleep Deprivation x Phases	.606	9, 1, 100	.98	108, 1483

** = $p < .01$

TABLE 13

3 x 2 x 7 ANOVA for the Dependent Measure
Latency to Sleep Onset

Source	df	MS	F
Behaviors (A)	2	687.0	.96
Sleep Deprivation (B)	1	808.0	1.13
Behaviors x Sleep Deprivation	2	232.0	.32
Subjects (Behaviors x Sleep Deprivation) (Error)	35	715.2	
Phases (C)	6	17029.0	94.60**
Behaviors x Phases	12	105.6	.59
Sleep Deprivation x Phases	6	190.0	1.05
Behaviors x Sleep Deprivation x Phases	12	196.8	1.09
Phases x Subjects (Behaviors x Sleep Deprivation) (Error)	210	180.0	

** = $p < .01$

TABLE 14

Average Sleep Onset in Minutes for the Seven Treatment Conditions during Baseline, Treatment, and Follow-Up

Groups	Baseline	Treatment Weeks 1	2	3	4	5	Follow-Up
High Deprivation-Unpleasant n=7	69	19	21	9	13	8	11
Low Deprivation-Unpleasant n=7	67	39	25	15	10	8	9
High Deprivation-Pleasant n=7	70	29	30	18	19	8	8
Low Deprivation-Pleasant n=7	69	29	31	21	17	10	9
High Deprivation-Neutral n=6	71	37	21	15	14	9	7
Low Deprivation-Neutral n=7	63	32	40	31	22	21	12
Self Relaxation-Placebo Control n=7	68	61	60	62	63	66	66

treatment groups combined had significant reductions in latency to sleep onset during treatment weeks one through five and follow-up when compared to baseline week. Similarly, the post hoc tests revealed that all six treatment groups combined had significant reductions on latency to sleep onset during treatment weeks three through five and follow-up when compared to treatment week one. Post hoc tests also revealed that all six treatment groups combined had significant reductions in latency to sleep onset during treatment weeks four, five, and follow-up when compared to treatment week two.

The results of degree of restedness are presented in Table 15 and indicate the phase main effect to be significant at the .01 level (F=17.90; df=6,210). The treatment means for degree of restedness are presented in Table 16. Scheffé post hoc tests indicated that the combined experimental groups reported being significantly more rested during treatment weeks five and follow-up than during baseline and treatment weeks one and two. Post hoc tests also revealed that subjects in all six treatment groups combined reported being significantly more rested during treatment weeks three and four than during baseline and treatment week one.

The results of reported difficulty getting to sleep are presented in Table 17 and indicate the phase main effect to be significant at the .01 level (F=27.58; df=6,210). The treatment means for reported difficulty getting to sleep are presented in Table 18. Scheffé post hoc tests indicated that

TABLE 15

3 x 2 x 7 ANOVA for the Dependent Measure
Degree of Restedness

Source	df	MS	F
Behaviors (A)	2	.32	.33
Sleep Deprivation (B)	1	.01	.01
Behaviors x Sleep Deprivation	2	1.70	1.77
Subjects (Behaviors x Sleep Deprivation) (Error)	35	.96	
Phases (C)	6	3.74	17.90**
Behaviors x Phases	12	.21	.96
Sleep Deprivation x Phases	6	.19	.85
Behaviors x Sleep Deprivation x Phases	12	.21	.96
Phases x Subjects (Behaviors x Sleep Deprivation) (Error)	210	.22	

** = $p < .01$

TABLE 16

Treatment Means for the Dependent Measure Degree of Restedness upon Awakening (on a 1 to 4 Scale, Where 1 = Very Rested and 4 = Not Rested at All) for All Seven Treatments across All Seven Phases

Groups	Base line	Treatment Weeks 1	2	3	4	5	Follow-up
High Deprivation-Unpleasant n=7	2.5	2.3	2.1	1.9	1.7	1.9	1.7
Low Deprivation-Unpleasant n=7	2.3	2.2	1.9	1.5	1.4	1.5	1.4
High Deprivation-Pleasant n=7	2.4	2.0	2.1	1.8	1.7	1.5	1.7
Low Deprivation-Pleasant n=7	2.5	2.3	2.2	1.9	2.3	1.9	1.7
High Deprivation-Neutral n=6	2.6	2.4	2.1	2.0	1.7	1.4	1.2
Low Deprivation-Neutral n=7	2.1	2.3	1.8	1.9	2.0	1.7	1.6
Placeo-Control n=7	2.8	2.9	2.5	2.7	2.8	2.7	2.7

TABLE 17

3 x 2 x 7 ANOVA for the Dependent Measure
Difficulty Getting to Sleep

Source	df	MS	F
Behaviors (A)	2	2.10	1.76
Sleep Deprivation (B)	1	.31	.26
Behaviors x Sleep Deprivation	2	.12	.10
Subjects (Behaviors x Sleep Deprivation) (Error)	35	1.19	
Phases (C)	6	9.10	27.58**
Behaviors x Phases	12	.24	.73
Sleep Deprivation x Phases	6	.34	1.03
Behaviors x Sleep Deprivation x Phases	12	.19	.58
Phases x Subjects (Behaviors x Sleep Deprivation) (Error)	210	.33	

** = $p < .01$

TABLE 18

Treatment Means for the Dependent Measure Difficulty Getting to Sleep (On a 1 to 5 Scale, Where 1 = No Difficulty, and 5 = Much Difficulty) for All Seven Treatments across All Seven Phases

Groups	Base line	Treatment Weeks 1	2	3	4	5	Follow-up
High Deprivation-Unpleasant n=7	2.7	1.8	1.8	1.5	1.8	1.5	1.6
Low Deprivation-Unpleasant n=7	2.4	1.9	2.1	1.9	1.5	1.5	1.4
High Deprivation-Pleasant n=7	3.0	2.1	2.4	1.6	1.6	1.4	1.5
Low Deprivation-Pleasant n=7	2.7	2.4	2.0	2.0	2.0	1.6	1.5
High Deprivation-Neutral n=6	3.2	2.5	2.2	2.0	1.8	1.4	1.2
Low Deprivation-Neutral n=7	3.1	2.4	2.3	2.1	2.0	1.7	1.6
Placebo-Control n=7	2.8	3.4	3.3	3.2	3.2	3.5	3.3

subjects over all six treatment groups reported having significantly less difficulty getting to sleep during treatment weeks one through five and follow-up when compared with baseline. Other post hoc tests revealed that the experimental subjects reported having significantly less difficulty getting to sleep during treatment weeks five and follow-up when compared to baseline and treatment weeks one and two.

The results of the dependent measure awakenings per night are presented in Table 19 and indicate that the phase main effect and the behaviors x sleep deprivation x phase interaction were significant at the .01 and .05 levels, respectively (F=10.34; df=6,210; and F=1.89; df=12,210). The treatment means for all groups are presented in Table 20. Treatment means for the three-way interaction are presented in Table 21. The three-way interaction (for behaviors and phases at sleep deprivation) indicates that the ordering of the three behavioral conditions interacts with the phases differently for the two sleep-deprivation conditions. Scheffe' post hocs were attempted but failed to indicate significant differences between treatment means, because of their conservative nature. Since there was a significant F a less conservative test was used. Tukey post hoc tests revealed that the high sleep-deprivation,pleasant group had significantly fewer awakenings during treatments weeks three, four, five, and follow-up as compared to baseline week. Tukey post hoc tests also indicated that the high sleep-deprivation, neutral group had significantly fewer awakenings during

TABLE 19

3 x 2 x 7 ANOVA for the Dependent Measure
Awakenings Per Night

Source	df	MS	F
Behaviors (A)	2	12.40	.41
Sleep Deprivation (B)	1	2.40	.08
Behaviors x Sleep Deprivation	2	8.50	.28
Subjects (Behaviors x Sleep Deprivation) (Error)	35	29.88	
Phases (C)	6	79.70	10.34**
Behaviors x Phases	12	8.50	1.09
Sleep Deprivation x Phases	6	6.30	.83
Behaviors x Sleep Deprivation x Phases	12	14.60	1.89*
Phases x Subjects (Behaviors x Sleep Deprivation) (Error)	210	7.70	

* = $p < .05$

** = $p < .01$

TABLE 20

Treatment Means for the Dependent Measure Awakenings Per Night for All Seven Treatments Across All Seven Phases

Groups	Base line	Treatment Weeks 1	2	3	4	5	Follow-up
High Deprivation-Unpleasant n=7	4.7	2.0	2.3	1.4	1.9	1.1	4.7
Low Deprivation-Unpleasant n=7	5.0	4.7	2.6	1.6	2.6	.7	.6
High Deprivation-Pleasant n=7	7.9	3.7	3.1	2.3	2.1	.9	1.2
Low Deprivation-Pleasant n=7	5.4	3.3	4.0	3.9	2.6	2.3	2.1
High Deprivation-Neutral n=6	5.2	6.0	2.8	6.2	2.8	1.5	.8
Low Deprivation-Neutral n=7	4.6	3.0	5.1	2.1	2.4	1.1	.9
Placebo-Control n=7	8.0	8.0	7.1	5.2	7.1	7.0	6.2

TABLE 21

Summary Tables for the Three-Way Interaction and the Dependent Measure Awakening with the Behavior (A) and Phase (C) Factors Held Constant while the Sleep Deprivation (B) Factor Is Varied

	Baseline	Treatment Weeks					Follow-up	
	0	1	2	3	4	5	6	
Pleasant Condition	7.9	3.7	3.1	2.3	2.1	.9	1.3	High Sleep Deprivation Conditions
Unpleasant Condition	4.7	2.0	2.3	1.4	1.9	1.1	4.7	
Neutral Condition	5.2	6.0	2.8	6.3	2.8	1.3	.8	
Pleasant Condition	5.4	3.3	4.0	3.9	2.6	2.3	2.1	Low Sleep Deprivation Conditions
Unpleasant Condition	5.0	4.7	2.6	1.6	2.6	.7	.6	
Neutral Condition	4.6	3.0	5.1	2.1	2.4	1.1	.9	

follow-up than during treatments weeks one or three. All other Tukey post hoc tests of this three-way interaction were non-significant. It might be added that Tukey post hoc tests were used only in those cases where a significant *F* was obtained and Scheffe' post hoc tests failed to indicate any significant differences between treatment means.

The results of the dependent measure amount of sleep presented in Table 22 indicated that the phase and sleep-deprivation main effects and behaviors performed x sleep-deprivation interaction were significant at the .05, .01 and .05 levels, respectively (F=2.73; df=6,210; F=11.71; df=1, 35 and F=3.66; df=2, 35). The treatment means for all groups are presented in Table 23. The treatment means for the two-way interaction are presented in Table 24. Within the unpleasant conditions subjects in the low sleep-deprivation group were getting significantly more sleep than subjects in the high sleep-deprivation group across all seven phases. The reason why subjects in the other low sleep-deprivation groups were not getting significantly more sleep than subjects in the other high sleep-deprivation groups will be explained in the discussion section. Scheffe' post hoc tests were attempted on the phase treatment means but failed to indicate a significant difference between treatment means due to the conservative nature of the Scheffe'. Tukey post hoc tests indicated that subjects in all treatment groups combined were getting significantly more sleep during treatment week three and follow-up as compared with treatment week two.

TABLE 22

3 x 2 x 7 ANOVA for the Dependent Measure Amount of Sleep

Source	df	MS	F
Behaviors (A)	2	.17	.14
Sleep Deprivation (B)	1	14.40	11.71**
Behaviors x Sleep Deprivation	2	4.50	3.66*
Subjects (Behaviors x Sleep Deprivation) (Error)	35	1.23	
Phases (C)	6	1.39	2.73*
Behaviors x Phases	12	.69	1.36
Sleep Deprivation x Phases	6	.34	.66
Behaviors x Sleep Deprivation x Phases	12	.34	.67
Phases x Subjects (Behaviors x Sleep Deprivation) (Error)	210	.51	

* = $p < .05$

** = $p < .01$

TABLE 23

Treatment Means for the Dependent Measure Amount of Sleep (in Hours) for All Seven Groups across All Seven Phases

Groups	Baseline	Treatment Weeks 1	2	3	4	5	Follow-up
High Deprivation-Unpleasant n=7	7.0	6.9	6.7	7.2	6.6	7.3	7.2
Low Deprivation-Unpleasant n=7	7.0	8.0	7.2	8.0	7.9	8.1	7.9
High Deprivation-Pleasant n=7	7.4	7.5	7.1	7.4	7.0	7.3	7.5
Low Deprivation-Pleasant n=7	7.8	7.4	6.8	7.4	7.1	7.0	7.4
High Deprivation-Neutral n=6	6.6	6.9	6.9	7.0	7.1	6.8	7.2
Low Deprivation-Neutral n=7	7.0	7.3	7.4	8.2	7.7	7.6	7.8
Placebo-Control n=7	6.7	6.9	6.7	7.6	6.9	6.6	7.7

TABLE 24

Treatment Means for the Dependent Measure Amount of Sleep (in Hours) Averaged Across All Seven Phases

Behavior Performed When out of Bed	Number of Hours of Sleep	
	High Deprivation Seven	Low Deprivation Nine
Pleasant	7.4	7.3
Unpleasant	6.9	7.8
Neutral	7.0	7.6

n = 7 per condition except
n = 6 for the high deprivation-neutral group

The results of the dependent variable number of times out of bed before asleep presented in Table 25 indicate that the phase main effect and the three-way interaction of phase x behaviors x sleep deprivation were significant at the .01 and .05 levels, respectively (F=12.47; df=6, 210; F=2.09; df=12, 210). The treatment means for all groups are presented in Table 26. Tables 27 and 28 can be consulted with regard to the treatment means relating to the three-way interaction of phase x behaviors x sleep deprivation. The three-way interaction indicates that for behavior and phase factors at the sleep-deprivation factor, the ordering of the three behavioral conditions interacts with the phases differently for the two sleep-deprivation conditions. Scheffe post hoc tests were attempted, but failed to indicate significant differences between treatment means. Tukey post hoc tests indicated that for the high sleep-deprivation conditions at treatment week one, subjects in the unpleasant group were getting out of bed significantly fewer times before sleep than subjects in the neutral group. Post hoc tests further indicated that subjects in the high sleep-deprivation, neutral group were getting out of bed significantly fewer times before asleep during treatment week five and follow-up as compared to treatment week one. Post hoc tests also indicated that for the low sleep-deprivation conditions at treatment week one, subjects in the pleasant and neutral groups were getting out of bed significantly fewer times before asleep than subjects in the unpleasant group.

TABLE 25

3 x 2 x 7 ANOVA for the Dependent Measure
Number of Times out of Bed

Source	df	MS	F
Behaviors (A)	2	19.70	.67
Sleep Deprivation (B)	1	63.50	2.17
Behaviors x Sleep Deprivation	2	9.73	.33
Subjects (Behaviors x Sleep Deprivation) (Error)	35	29.34	
Phases (C)	6	93.00	12.47**
Behaviors x Phases	12	7.90	1.07
Sleep Deprivation x Phases	6	8.50	1.14
Behaviors x Sleep Deprivation x Phases	12	15.60	2.09*
Phases x Subjects (Behaviors x Sleep Deprivation) (Error)	210	7.46	

* = $p < .05$

** = $p < .01$

TABLE 26

Treatment Means for the Dependent Measure Number of Times out of Bed Per Week for All Seven Treatments across All Seven Phases

Groups	Base line	Treatment Weeks 1	2	3	4	5	Follow-up
High Deprivation-Unpleasant n=7	3.8	1.3	3.0	.9	1.7	1.0	.6
Low Deprivation-Unpleasant n=7	3.9	9.7	3.8	1.7	1.4	1.3	1.4
High Deprivation-Pleasant n=7	2.4	3.1	5.0	2.8	2.6	.3	.3
Low Deprivation-Pleasant n=7	4.1	4.6	5.7	3.5	3.3	1.6	.1
High Deprivation-Neutral n=6	3.3	6.3	4.3	3.0	3.5	1.1	1.3
Low Deprivation-Neutral n=7	3.7	4.4	5.7	3.7	2.4	3.0	2.0
Placebo-Control n=7	3.7	2.3	1.8	1.7	1.8	1.4	1.4

TABLE 27

Summary Tables for the Three-Way Interaction and the Dependent Measure Number of Times out of Bed with the Behavior (A) and Phase (C) Factors Held Constant While the Sleep Deprivation (B) Factor Is Varied

	Phases							
	Baseline	Treatment Weeks					Follow-up	
	0	1	2	3	4	5	6	
Pleasant Condition	2.4	3.1	5.0	2.9	2.6	.3	.3	High Sleep Deprivation Conditions
Unpleasant Condition	3.9	1.3	3.0	.9	1.7	1.0	.6	
Neutral Condition	3.3	6.3	4.3	3.0	3.5	1.2	1.3	
Pleasant Condition	4.1	4.6	5.7	3.6	3.3	1.6	.1	Low Sleep Deprivation Conditions
Unpleasant Condition	3.9	9.7	3.9	1.7	1.4	1.3	1.4	
Neutral Condition	3.7	4.4	5.7	3.7	2.4	3.0	2.0	

TABLE 28

Summary Tables for the Three-Way Interaction and the Dependent Measure Number of Times Out of Bed with the Sleep Deprivation (B) and Phase (C) Factors Held Constant While the Behavior Factor is Varied

	Phases							
	Baseline	Treatment Weeks					Follow-up	
	0	1	2	3	4	5	6	
High Sleep Deprivation	2.4	3.1	5.0	2.9	2.6	.3	.3	Pleasant Conditions
Low Sleep Deprivation	4.1	4.6	5.7	3.6	3.3	1.6	.1	
High Sleep Deprivation	3.9	1.3	3.0	.9	1.7	1.0	.6	Unpleasant Conditions
Low Sleep Deprivation	3.9	9.7	3.9	1.7	1.4	1.3	1.4	
High Sleep Deprivation	3.3	6.3	4.3	3.0	3.5	1.2	1.3	Neutral Conditions
Low Sleep Deprivation	3.7	4.4	5.7	3.7	2.4	3.0	2.0	

Further post hoc tests revealed that subjects in the low sleep-deprivation, unpleasant group were getting out of bed significantly fewer times before asleep during the following phases: baseline, treatment weeks two, three, four, five, and follow-up when compared to treatment week one.

The three-way interaction for the sleep-deprivation and phase factors at the behaviors factor indicates that the two sleep-deprivation conditions interacted with the phases differently for the three behavioral conditions. Scheffe' post hoc tests were attempted and again failed to indicate significant differences between the treatment means. Tukey post hoc tests indicated that for the unpleasant condition at treatment week one, subjects in the high sleep-deprivation group were out of bed significantly fewer times before sleep than subjects in the low sleep-deprivation group.

The results for the dependent variable number of times out of bed for each day out of bed (which consists of the total number of times out of bed for the week divided by the number of days in which the client was out of bed at least once) are presented in Table 29 and indicate that both phase and behaviors performed main effects were significant at the .01 and .05 levels respectively (F=14.18; df=6, 210; F=4.74; df=2, 35). Treatment means for all the groups are presented in Table 30. Scheffe' post hoc tests indicated that subjects in the unpleasant conditions were out of bed significantly fewer times for each day out of bed than the neutral or

TABLE 29

3 x 2 x 7 ANOVA for the Dependent Variable
Number of Times out of Bed for Each Day out of Bed

Source	df	MS	F
Behaviors (A)	2	4.46	4.74*
Sleep Deprivation (B)	1	1.01	1.07
Behaviors x Sleep Deprivation	2	.02	.02
Subjects (Behaviors x Sleep Deprivation) (Error)	35	.94	
Phases (C)	6	4.40	14.18**
Behaviors x Phases	12	.38	1.23
Sleep Deprivation x Phases	6	.57	1.84
Behaviors x Sleep Deprivation x Phases	12	.42	1.36
Phases x Subjects (Behaviors x Sleep Deprivation) (Error)	210	.31	

* = $p < .05$

** = $p < .01$

TABLE 30

Treatment Means for the Dependent Measure Number of Times out of Bed for Each Day out of Bed for All Seven Groups across All Seven Phases

Groups	Base line	Treatment Weeks 1	2	3	4	5	Follow-up
High Deprivation-Unpleasant n=7	1.2	.4	1.0	.6	.3	.1	.3
Low Deprivation-Unpleasant n=7	.9	1.6	.7	.7	.5	.3	.2
High Deprivation-Pleasant n=7	1.1	1.0	1.3	1.0	1.0	.3	.3
Low Deprivation-Pleasant n=7	1.3	1.6	1.1	1.0	1.0	.4	.1
High Deprivation-Neutral n=6	.9	1.4	1.0	1.2	1.3	.6	.8
Low Deprivation-Neutral n=7	1.4	1.2	1.2	1.3	1.1	1.0	.7
Placebo-Control n=7	1.1	.9	.4	.7	.9	.8	.5

pleasant conditions when averaged across both sleep-deprivation levels and all seven phases. Post hoc tests also revealed that subjects in all six treatment groups combined were out of bed significantly fewer times for each day out of bed during treatment week five and follow-up when compared to baseline and treatment weeks one, two, and three.

The results of the dependent variable number of days out of bed (number of days in which the subject was out of bed at least once per day) are presented in Table 31 and indicate that the phase main effect was significant at the .01 level (F=16.30; df=6, 210). Treatment means for all the groups are presented in Table 32. Scheffe' post hoc tests indicated that subjects in the experimental groups were out of bed significantly fewer days during treatment week five and follow-up when compared to baseline and treatment weeks one, two, and three. Further post hoc tests revealed that subjects in all six combined treatment groups were out of bed significantly fewer days during treatment weeks three and four than during treatment week two.

The results of the dependent measure average number of minutes out of bed (on each night out of bed) are presented in Table 33 and indicate that both phases and behaviors performed main effects were significant at the .01 and .05 levels respectively (F=11.70; df=6, 210; F=4.35; df=2, 35). Treatment means for all the groups are presented in Table 34. Scheffe' post hoc tests indicated that the subjects in the

TABLE 31

3 x 2 x 7 ANOVA for the Dependent Variable
Number of Days out of Bed

Source	df	MS	F
Behaviors (A)	2	19.70	1.95
Sleep Deprivation (B)	1	24.99	2.48
Behaviors x Sleep Deprivation	2	3.52	.35
Subjects (Behaviors x Sleep Deprivation) (Error)	35	10.09	
Phases (C)	6	38.15	16.30**
Behaviors x Phases	12	4.17	1.78
Sleep Deprivation x Phases	6	1.79	.76
Behaviors x Sleep Deprivation x Phases	12	3.49	1.49
Phases x Subjects (Behaviors x Sleep Deprivation) (Error)	210	2.34	

** = $p < .01$

TABLE 32

Treatment Means for the Dependent Measure Number of Days out of Bed for All Seven Groups across All Seven Phases

Groups	Base line	Treatment Weeks 1	2	3	4	5	Follow-up
High Deprivation-Unpleasant n=7	3.0	1.3	2.0	.9	.9	.3	.6
Low Deprivation-Unpleasant n=7	2.7	4.3	2.7	2.1	1.1	1.1	1.0
High Deprivation-Pleasant n=7	1.4	2.1	3.8	1.8	2.4	.3	.3
Low Deprivation-Pleasant n=7	3.0	2.9	4.1	2.8	2.5	1.5	.1
High Deprivation-Neutral n=6	2.3	4.7	3.5	2.6	2.7	1.0	1.0
Low Deprivation-Neutral n=7	2.2	3.1	4.5	2.8	1.8	2.4	1.7
Placebo-Control n=7	2.5	1.6	1.2	1.0	1.3	1.2	1.0

TABLE 33

3 x 2 x 7 ANOVA for the Dependent Variable
Average Number of Minutes out of Bed

Source	df	MS	F
Behaviors (A)	2	431	4.35*
Sleep Deprivation (B)	1	285	2.88
Behaviors x Sleep Deprivation	2	273	2.76
Subjects (Behaviors x Sleep Deprivation) (Error)	35	99	
Phases (C)	6	468	11.70**
Behaviors x Phases	12	50	1.35
Sleep Deprivation x Phases	6	15	.37
Behaviors x Sleep Deprivation x Phases	12	31	.79
Phases x Subjects (Behaviors x Sleep Deprivation) (Error)	210	40	

* = $p < .05$

** = $p < .01$

TABLE 34

Treatment Means for the Dependent Measure Average Number of Minutes out of Bed for All Seven Groups across All Seven Phases

Groups	Baseline	Treatment Weeks 1	2	3	4	5	Follow-up
High Deprivation-Unpleasant n=7	7.8	7.8	12.0	4.5	1.5	1.4	3.5
Low Deprivation-Unpleasant n=7	3.5	6.8	8.2	4.1	4.7	2.8	1.4
High Deprivation-Pleasant n=7	4.2	9.2	14.8	11.4	8.1	1.0	1.7
Low Deprivation-Pleasant n=7	6.0	14.7	15.4	9.8	9.2	4.8	1.1
High Deprivation-Neutral n=6	5.5	9.1	7.5	7.5	6.5	2.8	3.5
Low Deprivation-Neutral	11.4	9.8	17.2	16.5	11.0	9.5	7.1
Placebo-Control n=7	5.0	4.8	2.0	3.2	3.7	2.4	2.1

unpleasant conditions were out of bed for significantly fewer minutes than the subjects in the pleasant and neutral conditions when averaged across both sleep-deprivation levels and all seven phases. Post hoc tests also revealed that subjects in all six treatment groups were out of bed for significantly fewer minutes during treatment weeks five and follow-up when compared with treatment weeks one, two, and three. Further post hoc tests indicated that subjects in the experimental groups were out of bed for significantly fewer minutes during treatment week four than during treatment week two.

In concluding this section on the three-factor ANOVAs performed, a summary of the significant relationships indicated by the post hoc tests calculated on the nine 3 x 2 x 7 ANOVAs is presented in Table 35. The significance of these findings will be evaluated in the discussion section.

Placebo-Group Comparisons

In order to compare the placebo-control group's performance as indicated by the nine dependent measures with the performance of the other six treatment groups, a series of two-factor analyses were performed. The treatment means for all groups can be consulted by referring back to the corresponding dependent measure in the 3 x 2 x 7 analyses. A 7 x 7 (seven phases x seven treatments) multivariate ANOVA using nine dependent measures (latency to sleep onset, number of times out of bed before asleep, degree of restedness, number of times awakened, difficulty getting to sleep, number of times out of bed

TABLE 35

A Summary of the Significant Relationships Indicated by Post Hoc Tests Performed on the Nine 3 x 2 x 7 ANOVAs

Dependent Measure	Significant Relationships
Latency	The six treatment groups combined had significant reductions in latency to sleep onset during treatment weeks one through five and follow-up when compared to baseline week. The six treatment groups combined also had significant reductions in latency to sleep onset during treatment weeks three through five and follow-up when compared to treatment week one. All six treatment groups combined also had significant reductions in latency to sleep onset during treatment weeks four, five and follow-up when compared to treatment week two.
Restedness	The combined treatment groups reported being significantly more rested during treatment week five and follow-up than during baseline and treatment weeks one and two. Subjects in the combined treatment groups reported being significantly more rested during treatment weeks three and four than during baseline and treatment week one.
Difficulty Getting to Sleep	Subjects combined over all six treatment groups reported having significantly less difficulty getting to sleep during treatment weeks one through five and follow-up when compared with baseline. The combined treatment groups reported having significantly less difficulty getting to sleep during treatment week five and follow-up when compared to baseline and treatment weeks one and two.
Awakenings	Subjects in the high sleep-deprivation, pleasant group had significantly fewer awakenings during treatment weeks three, four, five, and follow-up as compared to baseline week. Subjects in the high sleep-deprivation neutral group had significantly fewer awakenings during follow-up than during treatment weeks one or three.

TABLE 35 (continued)

Dependent Measure	Significant Relationships
Amount of Sleep	Within the unpleasant conditions subjects in the low sleep-deprivation group were getting significantly more sleep than subjects in the high sleep-deprivation group across all seven phases. Subjects in the combined treatment groups were getting significantly more sleep during treatment week three and follow-up as compared with treatment week two.
Number of Times Out of Bed	Within the low sleep-deprivation conditions at treatment week one, subjects in the pleasant and neutral groups were out of bed significantly fewer times than subjects in the unpleasant group. During treatment week one for the high sleep-deprivation condition, subjects in the unpleasant group were out of bed significantly fewer times before asleep than subjects in the neutral group. Within the unpleasant conditions at treatment week one subjects in the high sleep-deprivation group were out of bed significantly fewer times before asleep than subjects in the low sleep-deprivation group. The low sleep-deprivation, unpleasant group was out of bed significantly fewer times before asleep during the following phases: baseline, treatment weeks two, three, four, five, and follow-up when compared to treatment week one. Subjects in the high sleep deprivation-neutral group were out of bed significantly fewer times during treatment week five and follow-up when compared to treatment week one.
Number of Times Out of Bed for Each Day Out of Bed	Subjects in the unpleasant conditions were out of bed significantly fewer times for each day out of bed than the neutral or pleasant conditions when averaged across both sleep-deprivation levels and all seven phases. Subjects in the combined treatment groups were out of bed significantly fewer times for each day out of bed during treatment week five and follow-up when compared to baseline and treatment weeks one, two, and three.

TABLE 35 (continued)

Dependent Measure	Significant Relationships
Number of Days Out of Bed	Subjects in the combined treatment groups were out of bed significantly fewer days during treatment week five and follow-up when compared to baseline and treatment weeks one, two, and three. Other post hoc tests revealed that subjects in all six combined treatment groups were out of bed significantly fewer days during treatment weeks three and four than during treatment week two.
Average Number of Minutes Out of Bed	Subjects in all six treatment groups combined were out of bed for significantly fewer minutes during treatment week five and follow-up when compared with treatment weeks one, two, and three. Post hoc tests indicated that subjects in the combined six treatment groups were out of bed for significantly fewer minutes during treatment week four than during treatment week two.

on each day out of bed, number of days per week out of bed, average number of minutes out of bed, and amount of sleep) was conducted.

As indicated in Table 36, the treatment, phase, and treatment x phase effects were significant at the .01 level (F=3.20; df=369, 2118; F=11.69; df=54, 1218; and F=1.44; df=324, 2104). These results indicate that there were significant differences between the various treatment groups at certain phases with regards to some optimal combination of the above nine dependent measures. In order to assess more specifically where these significant differences were located, nine 7 x 7 (seven phases x seven treatments) univariate ANOVAs were performed. Each 7 x 7 ANOVA utilized one of the nine dependent measures previously mentioned.

Latency to sleep onset results are presented in Table 37 and indicate a significant phase and treatment x phase effect at the .01 level (F=93.11; df=6, 246; and F=3.2; df=36, 246). These results indicated that there was a significant difference in latency to sleep onset between certain treatment groups at various phases. Scheffe' post hoc tests indicated that at treatment week one the following groups were significantly lower in latency to sleep onset then the placebo-control group: high sleep-deprivation, unpleasant, high and low sleep-deprivation, pleasant, and low sleep-deprivation, neutral. At treatment weeks three, four, five, and follow-up, post hoc tests indicated that all active treatment groups

TABLE 36

Multivariate Analysis of Variance on the Nine Dependent Variables: Latency to Sleep Onset, Number of Times out of Bed before Asleep, Degree of Restedness, Number of Times Awakened, the Difficulty Getting to Sleep, Number of Times out of Bed on Each Day out of Bed, Number of Days per Week out of Bed, Average Number of Minutes out of Bed, and Amount of Sleep

Source	U-Statistic	df	Approximate F	df
Treatments	.020**	9, 15, 118	3.20**	369, 2118
Phases	.119**	6, 1, 118	11.69**	54, 1218
Treatment x Phases	.173**	9, 13, 118	1.44**	324, 2104

** = $p < .01$

TABLE 37

7 x 7 ANOVA for the Dependent Variable
Latency to Sleep Onset

Source	df	MS	F
Treatment	6	1490	1.55
Subjects (Treatment) (Error)	41	960	
Phases	6	14815	93.11**
Treatment x Phases	36	511	3.20**
Phases x Subjects (Treatment) (Error)	246	159	

** = $p < .01$

were significantly lower in latency to sleep onset than the placebo-control group. Scheffe' post hoc tests also indicated that each of the six active treatment groups significantly lowered their latency to sleep onset from baseline to all the remaining six phases. In other words, there were significant reductions from baseline to treatment weeks one, two, three, four, five, and follow-up for the six treatment groups.

The results of the dependent measure degree of restedness are presented in Table 38 and indicate the phase main effect to be significant at the .01 level (F=18.38; df=6, 246). Scheffe' post hoc tests indicated that subjects in all seven groups reported feeling significantly more rested upon awakening during treatment weeks three, four, five, and follow-up as compared to baseline week and treatment week one. Post hoc tests also revealed that subjects in all seven groups reported feeling significantly more rested upon awakening during follow-up than during treatment week two.

The results of the dependent measure reported difficulty getting to sleep are presented in Table 39 and indicate phases and treatment x phase effects to be significant at the .01 level (F=21; df=6, 246; F=1.88; df=36, 246). Scheffe' post hoc tests indicated that subjects in all six active treatment groups had significantly less reported difficulty getting to sleep than the placebo-control group at treatment week one. Further post hoc tests indicated that for the unpleasant conditions, subjects in the high and low sleep-

TABLE 38

7 x 7 ANOVA for the Dependent Variable
Degree of Restedness

Source	df	MS	F
Treatment	6	.68	.68
Subjects (Treatment) (Error)	41	1.00	
Phases	6	3.50	18.38**
Treatment x Phases	36	.25	1.28
Phases x Subjects (Treatment) (Error)	246	.19	

** = $p < .01$

TABLE 39

7 x 7 ANOVA for the Dependent Variable
Difficulty Getting to Sleep

Source	df	MS	F
Treatment	6	1.76	1.50
Subjects (Treatment) (Error)	41	1.19	
Phases	6	6.88	21.00**
Treatment x Phases	36	.62	1.88**
Phases x Subjects (Treatment) (Error)	246	.33	

** = $p < .01$

deprivation groups had significantly less reported difficulty getting to sleep in treatment week one than the following groups: low sleep-deprivation, pleasant; high and low sleep-deprivation, neutral; and placebo-control. The high sleep-deprivation, pleasant group also had significantly less reported difficulty getting to sleep than the high sleep-deprivation, neutral group in treatment week one.

Post hoc tests indicated on treatment week two that all active treatment groups had significantly less reported difficulty getting to sleep than the placebo-control group. Post hoc tests also indicated that the high sleep-deprivation, unpleasant group had significantly less reported difficulty getting to sleep on treatment week two than the high and low sleep-deprivation, neutral groups and the high sleep-deprivation, pleasant group. The low sleep-deprivation, pleasant group also had significantly less reported difficulty getting to sleep than the high sleep-deprivation, pleasant group in treatment week two.

Post hoc tests on treatment week three revealed that all active treatment groups had significantly less reported difficulty getting to sleep than the placebo-control. The high sleep-deprivation, unpleasant group also had significantly less reported difficulty getting to sleep than the following groups: low sleep-deprivation, unpleasant; low sleep-deprivation, pleasant; and high and low sleep-deprivation, neutral. Scheffe' post hoc tests for treatment week three indicated that the high sleep-deprivation, pleasant group had

significantly less reported difficulty getting to sleep than the following groups: low sleep-deprivation, pleasant; and high and low sleep-deprivation, neutral groups.

Post hoc tests for treatment week four indicated that all active treatment groups had significantly less reported difficulty getting to sleep than the placebo-control group. Further post hoc tests also indicated that the high sleep-deprivation, pleasant group and the low sleep-deprivation, unpleasant group had significantly less reported difficulty getting to sleep than the low sleep-deprivation, pleasant group and the low sleep-deprivation, neutral group during treatment week four.

In treatment week five post hoc tests indicated that all active treatment groups had significantly less reported difficulty getting to sleep than the placebo-control group. Scheffe post hoc tests also indicated that subjects in the high sleep-deprivation, unpleasant group had significantly less reported difficulty getting to sleep during each of the six phases as compared to the baseline phase. Subjects in the low sleep-deprivation, pleasant group had significantly less reported difficulty getting to sleep during treatment week five and follow-up than during baseline as indicated by post hoc tests. The Scheffe' post hoc tests revealed that subjects in the high sleep-deprivation, pleasant group had significantly less reported difficulty getting to sleep during each of the six phases (except treatment week two) as compared to baseline

week. Subjects in the high sleep-deprivation, pleasant group also had significantly less reported difficulty getting to sleep on treatment week five as compared to treatment week two.

Finally, subjects in the high sleep-deprivation, neutral group had significantly less reported difficulty getting to sleep during all the following treatment weeks: two, three, four, five, and follow-up, as compared to baseline as indicated by Scheffe' post hoc tests. The subjects in this group also had significantly less reported difficulty getting to sleep during treatment week five and follow-up as compared to treatment week one. The low sleep-deprivation, neutral subjects had significantly less reported difficulty getting to sleep during treatment weeks three, four, five, and follow-up as compared to baseline week. The subjects in this group also had significantly less reported difficulty getting to sleep in treatment week five and follow-up as compared to treatment week one.

The results of the dependent variable awakenings per night are presented in Table 40 and indicate that the phase main effect was significant at the .01 level (F=11.25; df=6, 246). Scheffe' post hoc tests revealed that subjects in all seven groups combined had significantly fewer awakenings during treatment weeks three, four, five, and follow-up week when compared to baselines. Further post hoc tests indicated that subjects in all seven groups combined had

TABLE 40

7 x 7 ANOVA for the Dependent Variable
Awakenings per Night

Source	df	MS	F
Treatment	6	17.00	.46
Subjects (Treatment) (Error)	41	37.07	
Phases	6	77.50	11.25**
Treatment x Phases	36	10.14	1.47
Phases x Subjects (Treatment) (Error)	246	6.89	

** = $p < .01$

significantly fewer awakenings during treatment week five and follow-up week when compared to treatment week one.

The results of the dependent measure amount of sleep are presented in Table 41 and indicate the phase main effect to be significant at the .01 level (F=4.10; df=6, 246). Scheffe' post hoc tests indicated that subjects in all seven groups combined got significantly more sleep during treatment week three and follow-up week than during the second treatment week.

The results of the dependent variable number of times out of bed before asleep are presented in Table 42 and indicate that both phase and treatment x phase effects were significant at the .01 and .05 levels respectively (F=13.20; df=6, 246; F=1.66; df=36, 246).

Scheffe' post hoc tests indicated that at treatment week one the following groups: high sleep-deprivation, unpleasant and pleasant, low sleep-deprivation, neutral, and the placebo-control group were out of bed significantly fewer times than the low sleep-deprivation, unpleasant group. Scheffe' post hoc tests also indicated that subjects in the low sleep-deprivation, unpleasant group were out of bed significantly fewer times during the following phases: baseline, treatment weeks two, three, four, five, and follow-up as compared to treatment week one. Post hoc tests for the low sleep-deprivation, pleasant group indicate that these subjects were out of bed significantly fewer times during follow-up than during treatment weeks one and two. Post hoc tests for the high

TABLE 41

7 x 7 ANOVA for the Dependent Variable
Amount of Sleep

Source	df	MS	F
Treatment	6	.65	.54
Subjects (Treatment) (Error)	41	1.21	
Phases	6	2.20	4.10 **
Treatment x Phases	36	.50	.93
Phases x Subjects (Treatment) (Error)	246	.54	

** = $p < .01$

TABLE 42

7 x 7 ANOVA for the Dependent Variable
Number of Times out of Bed before Asleep

Source	df	MS	F
Treatment	6	4.10	.13
Subjects (Treatment) (Error)	41	31.33	
Phases	6	87.20	13.20**
Treatment x Phases	36	10.97	1.66*
Phases x Subjects (Treatment) (Error)	246	6.61	

* = $p < .05$

** = $p < .01$

sleep-deprivation, pleasant group indicate that the subjects in this group were out of bed significantly fewer times during treatment week five and follow-up than during treatment week two. Post hoc tests for the high sleep-deprivation, neutral group indicate that the subjects in this group were out of bed significantly fewer times during treatment week five and follow-up than during treatment week one.

The results of the dependent variable number of times out of bed for each day out of bed are presented in Table 43 and indicate both phase and treatment x phase effects to be significant at the .01 and .05 levels respectively (F=13.99; df=6, 246; and F=1.61; df=36, 246). Scheffe' post hoc tests indicated that within the unpleasant conditions at treatment week one subjects in the high sleep-deprivation group were out of bed significantly fewer times (for each day out of bed) than subjects in the low sleep-deprivation group and also fewer than subjects in the low sleep-deprivation, pleasant group. Further post hoc tests indicated that within the high sleep-deprivation conditions at treatment week four subjects in the unpleasant group were out of bed significantly fewer times (for each day out of bed) than subjects in the neutral group.

Post hoc tests indicated that subjects in the high sleep-deprivation, unpleasant group were out of bed significantly fewer times (for each day out of bed) during treatment weeks four, five, and follow-up than during baseline

TABLE 43

7 x 7 ANOVA for the Dependent Variable
Number of Times out of Bed for Each Day out of Bed

Source	df	MS	F
Treatment	6	.28	.24
Subjects (Treatment) (Error)	41	1.17	
Phases	6	4.16	13.99**
Treatment x Phases	36	.48	1.61*
Phases x Subjects (Treatment) (Error)	246	.30	

* = $p < .05$

** = $p < .01$

week. Subjects in the high sleep-deprivation, unpleasant group were also out of bed significantly fewer times (for each day out of bed) during treatment week five as compared to treatment week two. Scheffe' post hoc tests indicated that subjects in the low sleep-deprivation, unpleasant group were out of bed significantly fewer times (for each day out of bed) during treatment weeks four, five, and follow-up than during treatment week one.

Finally, further post hoc tests revealed that subjects in the low sleep-deprivation, pleasant group were out of bed significantly fewer times (for each day out of bed) during follow-up week than during baseline and treatment weeks one and two. Also, subjects in this group were out of bed significantly fewer times (for each day out of bed) during treatment week five as compared to treatment week one. Post hoc tests further revealed that subjects in the high sleep-deprivation, pleasant group were out of bed significantly fewer times (for each day out of bed) during treatment week five and follow-up as compared to treatment week two.

The results of the dependent variable number of days out of bed (during which time the subject was out of bed at least once or more per day) are presented in Table 44 and indicate that phase and treatment x phase effects were significant at the .01 and .05 levels respectively (F=16.47; df=6, 246; and F=1.75; df=36, 246). Scheffe' post hoc tests revealed that during treatment week one subjects in the high

TABLE 44

7 x 7 ANOVA for the Dependent Variable
Number of Days out of Bed

Source	df	MS	F
Treatment	6	2.43	.23
Subjects (Treatment) (Error)	41	10.68	
Phases	6	34.80	16.47**
Treatment x Phases	36	3.72	1.75*
Phases x Subjects (Treatment) (Error)	246	2.12	

* = $p < .05$

** = $p < .01$

sleep-deprivation, unpleasant group and the placebo-control group were out of bed significantly fewer days per week than subjects in the high sleep-deprivation, neutral and low sleep-deprivation, unpleasant groups. Further post hoc tests indicated that during treatment week two, subjects in the placebo-control group were out of bed significantly fewer days per week than subjects in the low sleep-deprivation, neutral group. Post hoc tests also revealed that subjects in the high sleep-deprivation, unpleasant group were out of bed on significantly fewer days per week during treatment week five and follow-up than during baseline week. Post hoc tests indicated that subjects in the low sleep-deprivation, unpleasant group were out of bed on significantly fewer days per week during treatment weeks four, five, and follow-up than during treatment week one. Scheffe' post hoc tests revealed that subjects in the low sleep-deprivation, pleasant group were out of bed significantly fewer days during follow-up week than during any other of the six remaining phases. Subjects in this group also were out of bed on significantly fewer days during treatment week five as compared to treatment week two. Finally, post hoc tests revealed that subjects in the high sleep-deprivation, pleasant group were out of bed on significantly fewer days during baseline and treatment week five and follow-up than during treatment week two. Scheffe' post hoc tests also indicated that subjects in the high sleep-deprivation, neutral group were out of bed on significantly fewer days during

treatment week five and follow-up than during treatment week one. Further post hoc tests indicated that subjects in the low sleep-deprivation, neutral group were out of bed on significantly fewer days during treatment week four and follow-up than during treatment week two.

The results of the dependent measure average number of minutes out of bed (on each day out of bed) are presented in Table 45 and indicate the phase main effect to be significant at the .01 level (F=11.50; df=6, 246). Scheffé post hoc tests revealed that all seven groups combined were out of bed for significantly fewer minutes (on each day out of bed) during baseline and treatment weeks four, five, and follow-up as compared to treatment weeks one, two, and three.

In concluding this section on two factor ANOVAs and paralleling the presentation of the three factor ANOVAs a summary of the significant relationships indicated by the post hoc tests performed on the nine 7 x 7 ANOVAs is presented in Table 46.

Time to Bed Variances

A 7 x 3 (seven treatment groups x three phases: baseline, treatment week three, and follow-up) ANOVA was performed to determine if there were significant differences in the time to bed variances between the seven treatment groups for the three phases: baseline, treatment week three, and follow-up. More specifically, were the subjects in certain

TABLE 45

7 x 7 ANOVA for the Dependent Variable
Average Number of Minutes out of Bed

Source	df	MS	F
Treatment	6	2.43	.03
Subjects (Treatment) (Error)	41	95.54	
Phases	6	407.70	11.50**
Treatment x Phases	36	41.73	1.17
Phases x Subjects (Treatment) (Error)	246	35.45	

** = $p < .01$

TABLE 46

A Summary of the Significant Relationships Indicated by Post Hoc Tests Performed on the Nine 7 x 7 ANOVAs

Dependent Measure	Significant Relationships
Latency	At treatment week one all groups (except high sleep-deprivation, neutral and low sleep-deprivation unpleasant) were significantly lower in latency to sleep onset than the placebo-control group. At treatment weeks three, four, five, and follow-up all active treatment groups were significantly lower in latency to sleep onset than the placebo-control group. Each of the six active treatment groups significantly lowered their latency to sleep onset from baseline to all the remaining six phases.
Restedness	Subjects in all seven groups reported feeling significantly more rested upon awakening during treatment weeks three, four, five, and follow-up as compared to baseline week and treatment week one. Subjects in all seven groups also reported feeling significantly more rested upon awakening during follow-up than during treatment week two.
Difficulty Getting to Sleep	Subjects in the six active treatment groups had significantly less reported difficulty getting to sleep than the placebo-control group at treatment week one. The high and low sleep-deprivation, unpleasant groups reported significantly less difficulty getting to sleep during treatment week one than all other groups except the high sleep-deprivation, pleasant group. Within the high sleep-deprivation conditions, the pleasant group had significantly less reported difficulty getting to sleep than the neutral group during treatment week one. During treatment week two, the high sleep-deprivation unpleasant group reported significantly less difficulty getting to sleep than the high and low sleep-deprivation, neutral groups and the high sleep-deprivation, pleasant group. Also during treatment week two within the pleasant conditions, subjects in the low sleep-deprivation group reported having significantly less difficulty getting to sleep than subjects in the high sleep-deprivation group.

TABLE 46 (continued)

Dependent Measure	Significant Relationships
Difficulty Getting to Sleep (continued)	During treatment week three the high sleep-deprivation, unpleasant group reported significantly less difficulty getting to sleep than all other groups except the high sleep-deprivation, pleasant group. Also during treatment week three subjects in the high sleep-deprivation, pleasant group reported significantly less difficulty getting to sleep than subjects in the low sleep-deprivation, pleasant group and subjects in the high and low sleep-deprivation, neutral groups. Finally, during treatment week four subjects in the high sleep-deprivation, pleasant and low sleep deprivation-unpleasant groups reported having significantly less difficulty getting to sleep than subjects in the low sleep-deprivation, pleasant group and the low sleep-deprivation, neutral group.
Awakenings	Subjects in all seven groups combined had significantly fewer awakenings during treatment weeks three, four, five, and follow-up when compared to baseline. Subjects in all seven groups combined had significantly fewer awakenings during treatment week five and follow-up week when compared to treatment week one.
Amount of Sleep	Subjects in all seven groups combined got significantly more sleep during treatment week three and follow-up week than during the second treatment week.
Number of Times out of Bed	During treatment week one subjects in the high sleep-deprivation, unpleasant and pleasant, low sleep-deprivation, neutral, and placebo-control groups were out of bed significantly fewer times before asleep than subjects in the low sleep-deprivation, unpleasant group. Subjects in the low sleep-deprivation, unpleasant group were out of bed significantly fewer times before asleep during all phases (except treatment week one) when compared to treatment week one. Subjects in the high and low sleep-deprivation, pleasant groups were out of bed significantly fewer times before asleep during follow-up than during treatment week two. Subjects in the high sleep

TABLE 46 (continued)

Dependent Measure	Significant Relationships
	vation-neutral group were out of bed significantly fewer times before asleep during treatment week five and follow-up than during treatment week one.
Number of Times Out of Bed for Each Day out of Bed	During treatment week one within the unpleasant conditions, subjects in the high sleep-deprivation group were out of bed significantly fewer times (for each night out of bed) than subjects in the low sleep-deprivation group and also fewer than subjects in the low sleep-deprivation, pleasant group. During treatment week four within the high sleep-deprivation conditions, subjects in the unpleasant group were out of bed significantly fewer times (for each day out of bed) than subjects in the neutral group. Subjects within the high sleep-deprivation, pleasant and unpleasant groups were out of bed significantly fewer times (for each day out of bed) during treatment week five than during treatment week two. Subjects within the low sleep-deprivation, pleasant and unpleasant groups were out of bed significantly fewer times (for each day out of bed) during treatment week five and follow-up than during treatment week one.
Number of Days Out of Bed	During treatment week one subjects in the high sleep deprivation, unpleasant group and the placebo control group were out of bed significantly fewer days per week than subjects in the high sleep-deprivation, neutral and low sleep-deprivation, unpleasant groups. During treatment week two subjects in the placebo-control group were out of bed significantly fewer days per week than subjects in the low sleep-deprivation, neutral group. Subjects in the pleasant-high and low sleep-deprivation conditions were out of bed significantly fewer days during follow-up as compared to treatment week two. Subjects in the low sleep-deprivation, unpleasant and high sleep-deprivation, neutral condition were out of bed significantly fewer days during treatment week five and follow-up as compared to

TABLE 46 (continued)

Dependent Measure	Significant Relationships
	treatment week one. Subjects in the low sleep-deprivation, neutral condition were out of bed significantly fewer days per week during treatment week four and follow-up than during treatment week two. Subjects in the high sleep-deprivation unpleasant group were out of bed on significantly fewer days per week during treatment week five and follow-up as compared to baseline week.
Average Number of Minutes Out of Bed	All seven groups combined were out of bed for significantly fewer minutes (on each time out of bed) during baseline and treatment weeks four, five, and follow-up as compared to treatment weeks one, two, and three.

groups going to bed at more consistent times than subjects in other groups across the three phases?

The results of this 7 x 3 ANOVA are summarized in Table 47 which reveals that both the treatment and phase main effects were significant at the .05 and .01 levels respectively (F=2.62; df=6, 41; and F=9.32; df=2, 82). Scheffe post hoc tests reveal that subjects in the low sleep-deprivation, neutral group were going to bed at significantly more variable times than subjects in the low sleep-deprivation, unpleasant group when averaged across baseline, treatment week three and follow-up. Further post hoc tests revealed that subjects in the combined seven groups were going to bed at significantly more variable times during baseline than during follow-up week.

Subject Ratings of Therapeutic Steps

During the fifth therapy session all subjects in the six active treatments were asked to rank-order in terms of therapeutic effectiveness (more specifically, which steps worked best for them) the five steps of each therapy condition: go to bed only when sleepy; do not read, watch television, or eat in bed; if unable to fall asleep after ten minutes get up immediately and do one of the three behaviors which you have selected (either pleasant, unpleasant, or neutral); do not take naps during the day; set your alarm clock so that you are sure to get a minimum of seven (or nine) hours of sleep a night.

TABLE 47

7 x 3 ANOVA on the Time to Bed Variance

Source	df	MS	F
Treatment	6	4.08	2.62*
Subjects (Treatment) (Error)	41	1.56	
Phases	2	8.48	9.32**
Treatment x Phases	12	.67	.74
Phases x Subjects (Treatment) (Error)	82	.91	

* $p < .05$

** $p < .01$

Friedman's nonparametric tests (Hays, 1963) were performed on the totals of the rankings made on each of the five steps for each of the six therapy groups. These tests were performed to assess which therapy step was selected significantly more often as the most important step by subjects in each therapy group. The mean rankings made by the subjects are presented in Table 48.

The results of the Friedman tests for the high deprivation, unpleasant group were that these subjects chose step one (go to bed only when sleepy) as the most helpful step significantly more ($p < .01$) than step two (do not read, watch television, or eat in bed). The results of the Friedman tests for the low deprivation, unpleasant group were that these subjects did not choose any step as being most helpful significantly more than any other step. Further results of the tests revealed that the low deprivation, pleasant group chose step one (go to bed only when sleepy) as the most helpful step significantly more ($p < .05$) than step two (do not read, watch television, or eat in bed). Results of the tests for the high deprivation, pleasant group indicated that these subjects chose step one (go to bed only when sleepy) as the most helpful step significantly more ($p < .01$) than step five (set your alarm clock so that you are sure to get a minimum of seven [or nine] hours of sleep a night). Friedman's tests also revealed that subjects in the high deprivation, neutral group chose step five (set your alarm clock so that you are

TABLE 48

Mean Rankings of the Five Treatment Steps for the Six Active Treatment Groups
(Low Numbers Indicate Ranking in First Position Most Often)

Groups	Steps 1	2	3	4	5	
High Deprivation-Unpleasant n=7	1.43	4.43	3.71	2.57	2.85	**
Low Deprivation-Unpleasant n=7	1.71	4.28	1.57	2.86	3.57	
High Deprivation-Pleasant n=7	1.43	4.14	2.86	2.14	4.43	**
Low Deprivation-Pleasant n=7	2.0	4.28	2.28	2.43	4.00	*
High Deprivation-Neutral n=6	4.0	4.5	2.00	2.67	1.80	**
Low Deprivation-Neutral n=7	2.0	3.86	3.28	3.86	2.00	*

* = $p < .05$

** = $p < .01$

Step 1 = Go to bed only when sleepy.

Step 2 = Do not read, watch T.V., or eat in bed.

Step 3 = If unable to fall asleep after ten minutes get up immediately and do one of the three behaviors which you have selected (either pleasant, unpleasant, or neutral).

Step 4 = Do not take naps during the day.

Step 5 = Set your alarm clock so that you are sure to get a minimum of seven (or nine) hours of sleep a night.

sure to get a minimum of seven (or nine) hours of sleep a night) as the most helpful step significantly more ($p < .01$) than step two (do not read, watch television, or eat in bed). Finally, Friedman's tests revealed that subjects in the low deprivation, neutral group chose steps one (go to bed only when sleepy) and five (set your alarm clock so that you are sure to get a minimum of seven (or nine) hours of sleep a night) as the most helpful significantly more ($p < .05$) than steps two (do not read, watch television, or eat in bed) and four (do not take naps during the day).

In summary, subjects within the neutral, high and low sleep-deprivation conditions chose step five (set your alarm clock so that you are sure to get a minimum of seven (or nine) hours of sleep a night) as the most helpful step significantly more than step two (do not read, watch television, or eat in bed). Subjects within the unpleasant, high and low sleep-deprivation conditions chose step one (go to bed only when sleepy) as the most helpful step significantly more than step two (do not read, watch television or eat in bed). Subjects in the high sleep-deprivation, pleasant group chose step one (go to bed only when sleepy) as the most helpful step significantly more than step five (set your alarm clock so that you are sure to get a minimum of seven (or nine) hours of sleep a night). Finally, subjects in the low sleep-deprivation, pleasant group chose step one (go to bed only when sleepy) as the most helpful step significantly more than step two (do not read, watch television, or eat in bed).

CHAPTER IV

DISCUSSION

All six active stimulus-control treatment groups reported significantly reduced their latencies to sleep onset from baseline to follow-up week, relative to the placebo-control group. These findings provide support for the therapeutic effectiveness of stimulus-control approaches in the treatment of sleep disturbances and are concordant with several previous studies which also demonstrated the efficacy of stimulus-control procedures (Bootzin, 1972, 1973; Lawrence et al., 1975; Price et al., 1974; Tokarz & Lawrence, 1974).

The goal of the current study was to further isolate two factors (sleep deprivation and behaviors performed when out of bed) which may be operating to produce stimulus control's efficacy in treating sleep disturbances. Previous research (Tokarz & Lawrence, 1974) had demonstrated that stimulus-control subjects were getting reduced amounts of sleep and thus that stimulus control could be operating to reduce latency to sleep onset via a sleep-deprivation mechanism. This sleep-deprivation mechanism would operate in the case where the client got a reduced amount of sleep on a particular night and then would fall asleep more quickly on the subsequent night. Since previous research has not manipulated the amount of time clients were asleep, the current study

controlled for this factor by instructing clients to get either seven or nine hours of sleep. The hypothesis was that subjects in the seven-hour conditions of the stimulus-control procedure should have gotten to sleep more quickly than subjects in the nine-hour conditions of the stimulus-control procedure.

The other factor manipulated in the current study was the quality of the behavior performed by the subject once he or she got out of bed after not being able to fall asleep within 10 minutes. All previous research in stimulus control has left the quality of the behavior to the discretion of the client, whereas in the present study subjects in separate conditions were asked to perform either pleasant, unpleasant, or neutral behaviors once out of bed. The hypothesis behind this manipulation was that subjects who had to perform unpleasant behaviors should have found that getting out of bed was more aversive than subjects who had to perform either pleasant or neutral behaviors. Subjects in the unpleasant condition should, therefore, have gotten out of bed less frequently and thereby fallen asleep more quickly.

The results from the current study provide partial support for these two hypotheses. This support comes from the high sleep-deprivation, unpleasant group's pattern of superior performance as indicated by several of the dependent measures. The high sleep-deprivation, unpleasant group had significantly less reported difficulty getting to sleep during

treatment week one than all other groups except the high sleep-deprivation, pleasant and low sleep-deprivation, unpleasant groups. During treatment week two, the high sleep-deprivation, unpleasant group had significantly less reported difficulty getting to sleep than the high and low sleep-deprivation, neutral groups and the high sleep-deprivation, pleasant group. Also during treatment week three, the high sleep-deprivation, unpleasant group had significantly less reported difficulty getting to sleep than all other groups except the high sleep-deprivation, pleasant group. On the dependent measure total number of times out of bed before asleep per week the subjects in the high sleep-deprivation, unpleasant group were out of bed significantly fewer times during treatment week one than subjects in the high sleep-deprivation, neutral and low sleep-deprivation, pleasant groups. On the dependent measure number of times out of bed for each day out of bed, subjects in all unpleasant conditions were out of bed significantly fewer times than subjects in the neutral or pleasant conditions when averaged across both sleep-deprivation levels and all seven phases. During treatment week one subjects in the high sleep-deprivation, unpleasant group were out of bed significantly fewer times for each day out of bed than subjects in the low sleep-deprivation, pleasant and unpleasant groups. Also, during treatment week four, subjects in the high sleep-deprivation, unpleasant group were out of bed significantly fewer times for each day out of bed than subjects in the high sleep-deprivation, neutral group. On the

dependent measure number of days out of bed (with one or more times out of bed per day) subjects in the high sleep-deprivation, unpleasant group were out of bed significantly fewer days than subjects in the high sleep-deprivation, neutral and low sleep-deprivation, unpleasant groups during treatment week one.

These results partially support the premise that getting less sleep can facilitate the reduction of sleep disturbances. The results also indicate that the subjects in the low and high sleep-deprivation, unpleasant groups followed the therapy instructions most accurately out of all six active treatment groups. The high sleep-deprivation, unpleasant group had 6.9 hours of sleep and the low sleep-deprivation, unpleasant group had 7.8 hours of sleep when averaged across all seven phases. Since the high sleep-deprivation, unplesasant group was getting significantly less sleep as compared to the low sleep-deprivation, unpleasant group, the conditions to produce sleep-deprivation were being met for the high sleep-deprivation, unpleasant group. Although the high sleep-deprivation, unpleasant group was not significantly different from the other five active treatment groups in terms of latency to sleep onset, it tended to have numerically the lowest latency to sleep onset during treatment weeks one, two, and three. A trend, however, is not a significant difference, and, therefore, in terms of latency to sleep onset, the sleep-deprivation hypothesis was not entirely supported. It can be concluded that the sleep-deprivation hypothesis,

which posits that getting less sleep can facilitate the reduction of sleep-disturbances, did receive partial support. Even though subjects in the high sleep-deprivation conditions were getting seven hours of sleep a night, there were still no significant differences between the seven treatment groups on degree of restedness. This implies that subjects can regularly (for five weeks) get seven hours of sleep a night and still feel rested.

Some of the results previously mentioned also partially support the "behaviors-performed" hypothesis, in that subjects in the unpleasant conditions were out of bed significantly fewer times for each day out of bed than subjects in the pleasant or neutral groups, when averaged across both sleep-deprivation levels and all seven phases. The fact that the performance of unpleasant behaviors should lead to a significant reduction in number of times out of bed (for each day out of bed) was supported. It was further hypothesized that since the subjects were out of bed fewer times they should also have gotten to sleep more quickly. The latencies to sleep onset for the unpleasant conditions were not significantly different from the pleasant or neutral conditions, although there was a trend for the number of times out of bed (for each day out of bed) to parallel the latency to sleep onset. One possible reason why the latencies to sleep onset were not significantly shorter for the unpleasant

conditions (more specifically the high sleep-deprivation, unpleasant condition) could have been because the high sleep-deprivation, unpleasant group was out of bed .4 times for each day out of bed (during treatment week one) and all the other active treatment groups were out of bed approximately one time for each day out of bed. Since all the active treatment groups except the high sleep-deprivation, unpleasant group were only out of bed one time for each day out of bed it would not appear possible for these other groups to markedly diverge in latency to sleep onset from the high sleep-deprivation, unpleasant group because they have had to have been out of bed several times for each day for latencies to significantly differ. Finally, it could be concluded that the previously mentioned pattern of superior performance of the high sleep-deprivation, unpleasant group on several of the dependent measures does provide some support for the premise that subjects will get out of bed less frequently when they have to perform an unpleasant versus a pleasant or neutral behavior.

Since there was such a large number of dependent measures and thereby univariate ANOVAs in this study, the probability of a Type I error is considerably enhanced. Certainly some of the findings reported in this study might fit in this category; however, the principle behind Type I errors assumes that they will be randomly distributed across the various dependent-measure analyses. The fact that the high

sleep-deprivation, unpleasant group had a pattern of superior performances across several dependent measures when compared to the other six active treatment groups argues against the premise that these results were simply due to Type I error. It, therefore, does not appear likely that chance or random errors produced the pattern of results arrived at by the high sleep-deprivation, unpleasant group.

In summary, the performance of the high sleep-deprivation, unpleasant group indicates that when a standard stimulus control procedure is used, the addition of instructing clients to get seven hours of sleep and to perform only unpleasant behaviors when out of bed could result in significantly less reported difficulty getting to sleep, a reduced number of times out of bed, a reduced number of times out of bed for each day out of bed, and a reduced number of days out of bed during the first week or two of therapy.

Certainly from a clinical perspective, a therapist would like to use a therapy procedure which involves a minimum expenditure of energy on the part of the client. Reductions in reported difficulty getting to sleep and reductions in the amount of effort the client has to expend with regard to getting out of bed during the first week of therapy would accordingly appear to have a fair amount of clinical utility over and above the standard stimulus-control procedure. The importance of these possible effects occurring during the first week of therapy would be that within this interval of

time the client will be more highly motivated than during any other period of therapy. It would appear that the results of this study may provide a relevant clinical contribution that merits replication.

The next logical question would be that as to what factors or mechanisms led to the uniform and consistent reduction in latency to sleep onset for all six active treatment groups relative to the placebo-control group? One possibility could be that all six active treatment groups utilized the same basic aspect of the stimulus control procedures which involved the client getting out of bed if he or she was unable to fall asleep in ten minutes. Thus, it may have been that simply getting out of bed when unable to sleep after ten minutes was the feature that all groups had in common, and which produced the consistent reductions in latency to sleep onset. Bootzin (1972) subscribes to this view by postulating that the single act of getting out of bed is aversive, and it is this feature which he feels is the most important in reducing latency to sleep onset.

Another possibility which could have led to the reduction in latency to sleep onset for all six active treatment groups is a temporal stimulus factor. It may very well be that there are internal and external stimuli which become S^D's for certain compatible and incompatible sleep behaviors. The stimulus control which has been previously mentioned would refer to external stimuli (i.e., bed, bedroom, sheets,

etc.) which control sleep behavior. Similarly the temporal factor may be conceptualized as stimulus control via internal stimuli, since it is possible that going to bed at a consistent time might lead to some internal physiological change that becomes a discriminative stimulus for compatible sleep behaviors. In this conceptualization the role of stimulus control becomes expanded such that temporal and stimulus-control factors are viewed as internal and external stimuli which come to control sleep behavior. Tokarz and Lawrence (1974) found that subjects in a temporal group who got to bed and got up at consistent times reduced their latencies to sleep onset comparable to subjects in a stimulus control group. There also was some evidence for this temporal stimulus factor in the current study, in that time-to-bed variance analyses indicated that subjects in the combined seven groups were going to bed at significantly more variable times during baseline than during follow-up. Since the placebo-control group was part of the combined seven groups, however, it makes the temporal stimulus hypothesis a bit tenuous because the placebo subjects were not instructed to go to bed at consistent times. In all probability even though the placebo-control group was a part of the combined seven groups it most likely played only a small part relative to the other combined six groups with regard to the finding of significantly more variable times during baseline than during follow-up.

One reason indicating that this temporal stimulus factor may not have been the primary factor leading to the reductions

in latency to sleep onset would involve the variability of times to bed. If low variability of time to bed were associated with reduced latencies to sleep onset, and high variability with increased latencies, then the low sleep-deprivation, neutral group, which had significantly more variable times as compared to the low sleep-deprivation, unpleasant group (when averaged across baseline, treatment week three, and follow-up), should not have been similar in latency to sleep onset as compared to the other five active treatment groups at follow-up. A possible interpretation of this discrepancy is that the temporal stimulus factor (i.e., internal stimuli as S^D's) could have been operating more strongly in the low sleep-deprivation, unpleasant group, and that the stimulus control factor (i.e., external stimuli as S^D's) might have been operating more strongly in the low sleep-deprivation, neutral group to produce the reduction in latencies to sleep onset.

An important point to be considered in connection with this temporal or internal stimulus premise is that whenever instructions are given which call for subjects to get a prescribed amount of sleep, there is integrated within these instructions the possibility that temporal scheduling factors may develop. It is therefore difficult to ask subjects to get a set amount of sleep yet not go to bed at consistent times.

In summary, it would appear that temporal stimulus factors most likely play a role in the reduction of latency to

sleep onset; however, they are not the only factor responsible for latency reductions. The premise that the stimulus control (i.e., external stimuli) aspect of getting out of bed was the causal factor which led to the reduction in latency to sleep onset is possible, yet this factor still lacks supporting evidence which will have to come from future research. It may be, as previously suggested, that temporal and stimulus factors both are aspects of stimulus control with one referring to control by internal stimuli and the other referring to control by external stimuli. In this manner both internal and external stimuli may operate to bring about reduced latencies to sleep onset.

The next issue to be raised concerns the point of why the experimental manipulations were not more successful. The first hypothesis stated that the performance of unpleasand behaviors once out of bed should have led to a reduction in the number of times out of bed and also to a reduction in the latency to sleep onset. This hypothesis was only partially supported for several possible reasons.

First, it is possible that the behaviors which the subjects chose to perform at night were of a limited range and were not very different in terms of their unpleasant or pleasant qualities. Examples of the behaviors chosen as unpleasant were: writing letters, reading biology, reading psychology, and reading Thoreau. Examples of the behaviors chosen as pleasant were: needlepoint, reading an enjoyable

book, writing letters, and sketching. Examples of the behaviors chosen as neutral were: reading a psychology book, writing letters, straightening up the room, and cleaning records. Thus, there would appear to be a limited range of behaviors which could have been performed at night. More specifically, there were probably not a great many highly pleasurable behaviors which could have been chosen and performed by the subjects in their rooms at night. On the other hand, subjects also were probably reluctant to choose a behavior to perform which was of a truly aversive nature. It would seem that more aversive behaviors could have been chosen by the therapist than by the subjects. Under these conditions, with subjects performing highly aversive behaviors, there might have been significant differences between the behavioral conditions on the latencies to sleep onset.

The other hypothesis in the experiment to receive only partial support was the sleep-deprivation premise. When the amount of sleep for the six active treatment groups was assessed it was discovered that only the high and low sleep-deprivation, unpleasant groups had followed the instructions accurately and gotten 6.9 and 7.8 hours of sleep, respectively when averaged across all phases. Although this difference is significant, it still indicates that low sleep-deprivation, unpleasant subjects did not get the prescribed nine hours of sleep. There were no significant differences between the amount of time slept for the other high and low

deprivation conditions. The high and low sleep-deprivation, pleasant and neutral groups thus did not differ in the amount of sleep that they received when averaged across all seven phases. It may have been that if the low sleep-deprivation conditions had received the prescribed nine hours of sleep, this circumstance would have not reduced the latencies as much for those conditions, and there would have been significant differences between the high and low sleep-deprivation conditions in terms of latency to sleep onset. It may also be that undergraduate subjects may not be able to be prompted into getting a prescribed amount of sleep if it is above seven hours.

A possible reason why the low sleep-deprivation subjects were unable to get nine hours of sleep lay in their university schedules; as college students, these subjects probably stayed up until around midnight, due to studying, socializing, or through the distraction of the dormitory public address system (which does not shut off until midnight). If a set period is then allowed for the subjects to get to sleep, it would appear that they would have to sleep until some time after 9:00 a.m. in order to meet the prescribed nine hours of sleep. Many subjects, however, had early morning classes which had to be attended, prohibiting their following the requirement of nine hours of sleep. A more suitable population of subjects to use would be a population which did not have pressing early morning obligations or noise disturbances

at night and thus would be more likely to meet the prescribed sleep requirement.

A further possible reason why the two sleep-deprivation conditions did not differentially effect latency to sleep onset may be that even if the seven and nine hour conditions were followed they still represent a limited range. More specifically, it could be that a range of five versus ten hours (for example) would be necessary to demonstrate changes in latency to sleep onset between the two conditions. When the sleep deprivation hypothesis is considered, then it may be that seven hours of sleep on a given night might not have had as much effect on reducing latency to sleep onset for the subsequent night as would have five hours of sleep. Thus, the sleep-deprivation hypothesis may be viable, but more extreme levels of sleep deprivation may be necessary for its validity to be detected. If so, then significant differences in latency to sleep onset between subjects who get five hours of sleep versus subjects who get ten hours of sleep might be more probable than in the case of seven and nine hour sleep.

Issues related to reliability were also raised in this study and need to be discussed. The utilization of reliability measures on the various dependent measures in this study provides substantiation for the previous studies which have used this technique successfully (Lawrence, Tokarz & Hussian, 1975; Tokarz, 1972; Tokarz & Lawrence, 1974). Thoresen and Mahoney (1974) indicate that self-report data cannot

automatically be assumed to be accurate, and it should be the experimenter's responsibility to develop a method of reliability to empirically demonstrate the accuracy of self-reports. The finding in the current study that subjects and roommates for all seven groups across all six phases had a high degree of agreement on the dependent measures of time to bed, times out of bed prior to sleep, time to sleep, times awakened, and time up thus had import with regard to allowing more definitive conclusions to be made. The aspect of roommates observing subjects' sleep patterns twice during each of the six phases (excluding baseline) was similar to a "random check" condition in a reliability study performed by Taplin and Reid (1973). The random check condition in the Taplin and Reid (1973) study involved observers being told that reliability checks would be randomly performed on 20 percent of their behavior-coding sheets. This study also had a spot check condition in which observers were told that at some time after training, that spot checks would be conducted to determine whether codings were sufficiently accurate. Lastly there were subjects in a no-check group who were told that reliability checks would not be performed on them; however, covert reliability checks were still performed. The results of Taplin and Reid (1973) study demonstrated that the spot check group had high reliability during spot checks but not during unmonitored sessions. The relation of Taplin and Reid's (1973) work to the current endeavor is that it

points to the possibility that the accuracy of subject sleep data recording is not necessarily as high during non-monitored as during monitored days.

Another concern of Thoresen and Mahoney (1974) is that it makes little difference if some therapeutic technique would have been effective if implemented, when such implementation was either non-existent or not evaluated; therefore, another type of reliability was assessed by percent agreement of roommate with subject's reports, and used to provide a check on the experimental manipulation. This check involved the roommates in the six active treatment groups reporting on the behaviors the subjects had selected to perform. Through this technique, it was confirmed by a high degree of agreement between subjects and roommates that the subjects were in fact performing the prescribed behaviors for their appropriate therapy conditions. It can be concluded that the utilization of reliability measures has provided substantiation for the fact that subjects and roommates were in high agreement on the various dependent measures and behaviors performed or observed by each throughout the six phases of the study.

Also within a methodological perspective the criticism has been raised that placebo groups may not adequately control for expectancy of improvement (Baker & Kahn, 1972). Recent research by Borkovec and Nau (1972) suggests that placebo procedures generally used are not viewed as having the same credibility as the active therapy procedures. In

connection with this point, in the current study, 14 students from Psychology 505 at the University of North Carolina at Greensboro were given written descriptions of all seven therapy rationales. They were then asked to rate them on two 10-point scales of how logical each of the seven rationales sounded and how therapeutically effective each would be. The results indicated that no therapy rationale was rated as more or less logical than another, nor more or less potentially therapeutically effective than another. These results support the suggestion that independent raters evaluated the placebo-control rationale as being as credible as the other six therapy rationales. At the end of the first treatment session, subjects in all seven treatment groups were also asked to rate on a 10-point scale how logical and therapeutically effective they believed the therapy just explained would be. This procedure was identical to the technique used by Borkovec et al. (1974) to assess the credibility of his therapy techniques for the different conditions. The results of the analyses of these two scales indicated that the no-treatment, or placebo procedure was rated as more or less logical or potentially therapeutically effective by the subjects in all seven groups. These results provide further support for the perceived credibility of the placebo-control procedure by the subjects within it. They also indicate that no treatment procedure among the six was rated as more or less logical or potentially therapeutically effective by the subjects in these six treatment groups.

Another factor which could influence therapeutic results would be differential motivational levels for improvement among the subjects in the seven groups. Such a possibility was investigated by asking subjects in all groups during the first therapy session to rate on a 10-point scale their degree of motivation to improve their sleep patterns. The results of the analysis of the motivation ratings indicated that there were no significant differences in motivation to improve among the subjects in one group as compared with another. That finding provides support for the premise that the subjects in all seven treatment conditions had similar levels of motivation for reducing their sleep problems. In conclusion, the results from these three rating systems provide evidence that the differential performances of the various therapy conditions were not due to differences in credibility or motivation levels among the seven treatments.

An important assessment in any clinical endeavor would be to ask the client what factors he or she believed caused the clinical improvement. The importance of this assessment is that it enables the clinician to compare various theoretical hypotheses with client suggestions regarding causal factors behind clinical improvement. It could also aid the clinician in discovering hitherto unthought-of factors. Subjects in the six active treatment groups were thus asked to rank-order the five steps which composed each of their therapies. The data obtained indicated that subjects in

the high and low sleep-deprivation, pleasant and unpleasant conditions chose step one (go to bed only when sleepy) as the most helpful step. Subjects in the high and low sleep-deprivation, neutral conditions chose step five (set your alarm clock so that you are sure to get a minimum of seven [or nine] hours of sleep a night) as the most helpful step. Since the majority of subjects rated going to bed only when sleepy as the most helpful step, and the remaining subjects rated setting their alarm clocks so that they got seven (or nine) hours of sleep, as the most helpful step when compared to stimulus-control factors (i.e., do not read, watch television, or eat in bed), investigators might be reasonably directed to further study lateness to bed and sleep-deprivation factors.

Recommendations for Future Research

At this point, the lessons learned from the present investigation will be utilized to make several recommendations for conducting future research on the effects of high and low sleep deprivation and the qualities of the behaviors performed once out of bed in the treatment of sleep disturbances.

The first recommendation would be for researchers to use a population of subjects that had noise-free night-time environments and/or schedules which allowed sleeping late in the mornings. By using subjects who were either able to get to sleep earlier and/or sleep late in the morning the

researcher would increase his chances of having the nine-hour sleep requirement complied with.

The second recommendation would be for researchers to use extreme values on the amount-of-sleep dimension, such as five and ten hours of sleep in order to maximize the chances of establishing a sleep-deprivation effect of a magnitude which would produce significant differences in latency to sleep onset between the two sleep-deprivation levels. Although this manipulation would maximize the probability of establishing a sleep-deprivation effect it would also have the disadvantages of being unfeasible (most people would not agree to get five hours of sleep a night) and unethical (a researcher should probably not ask his subjects to follow such a program, in any case).

The third recommendation would be an alternative way of manipulating sleep deprivation. Stimulus-control procedures may be effective through people getting out of bed when they cannot sleep and possibly getting less sleep thereby causing sleep deprivation. It would be suggested that researchers manipulate how long subjects stay out of bed once they get out of bed. Different conditions could look at the effects of asking subjects to stay up for at least 7, 10, or 30 minutes for each time they get out of bed. Also, all subjects could be asked to not sleep past a certain time in the morning (e.g., 9:00 a.m.) to insure that subjects didn't compensate for the delay in getting to sleep at night by sleeping later in the morning. As with all manipulations there would

be disadvantages; in this case subjects in the various conditions (i.e., 7, 10, or 30 minutes out of bed) might not spend the prescribed time out of bed since the instructions would be to spend at least 7 minutes (or 10, or 30 minutes) out of bed. It could turn out that subjects in all conditions might spend 30 minutes out of bed. This situation would appear to have a low probability of occurrence, however, since subjects in the current study who had total flexibility to spend as much time out of bed as they wanted spent only an average of seven minutes out of bed. It would be predicted that subjects who had to stay up 30 minutes for each time they got out of bed would be more sleep-deprived than subjects who had to stay up 7 minutes since all subjects had to get up at the same time each morning; therefore, if sleep deprivation was an important causal factor in stimulus control it would be posited that the 30-minute condition should have shorter latencies to sleep onset than subjects in the seven-minute condition.

Another series of disadvantages of this latter approach to studying sleep deprivation would be that the effects of the manipulation would lead to sleep deprivation only in the early phases of treatment when subjects were getting out of bed quite frequently. After the early phases, when subjects were out of bed only one time a night or fewer the manipulation would not produce sleep deprivation. Also, even if the subjects who had to spend 30 minutes out of bed reduced their

latencies to sleep onset relative to the seven-minute condition, this would not have to be attributable simply to sleep deprivation. It may be that spending more time out of bed is more aversive, and it is this aversive factor which led to the latency reductions.

The fourth recommendation for future research would be for researchers to have subjects in the various behavior conditions (i.e., unpleasant, and pleasant) list all the possible aversive and pleasant behaviors that they have carried out, or could, in their rooms. Subjects would be encouraged to list behaviors which they find particularly distasteful even if they rarely ever perform them. Once the list has been composed it would be a matter of the therapist attempting to have the subject select the most unpleasant and pleasant behaviors from the list. In this manner subjects would present to the therapist a larger range of possible behaviors to choose from as opposed to the subject merely choosing a behavior on his own without the therapist knowing the relative standing of that behavior in terms of its pleasant or unpleasant qualities. Thus, it would be more probable that subjects would be performing maximally pleasant and unpleasant behaviors.

Finally, in summarizing the experiment, the results of this endeavor support the general finding that the stimulus-control procedure is an effective treatment for sleep disturbances. The results also partially support the premise

that getting less sleep can facilitate the reduction of sleep disturbances. They also partially support the premise that the performance of unpleasant behaviors relative to pleasant or neutral behaviors can facilitate the reduction of sleep disturbances. The behaviors-performed hypothesis was also partially supported by the fact that the subjects in the high sleep-deprivation, unpleasant group reported significantly less difficulty getting to sleep than subjects in some of the other groups. Only through future research in this area, nevertheless, will the above findings be either confirmed or not.

There are other possible conclusions to be reached from the results of this study. One possibility could be that the sleep-deprivation and behavioral factors are minor components with regard to the effectiveness of the stimulus control procedure in reducing latencies to sleep onset. If these two factors did play a minor role as components of stimulus control, then significant differences between the treatment conditions would not be expected, because all the groups may still have had a major procedural component in common which brought about the reductions in latency to sleep onset. If this possibility were true, it might imply that the results found by Tokarz and Lawrence (1974), with regard to the stimulus control group getting significantly less sleep than the other two treatment conditions, may have been simply a by-product or concomitant aspect of the stimulus-control

procedures, and not the mechanism by which subjects in that group reduced their latencies to sleep onset.

It is important that the results of any research endeavor be interpreted and considered from several viewpoints or possibilities, for only in this manner can the directions of future research be determined. The necessity for researchers to have several possible avenues to select from and explore, as compared to singular conclusions, cannot be underemphasized. The opening of many avenues of exploration and research will provide the possibility of arriving at the true cause or causes of sleep difficulties.

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