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EFFECTS OF NAPPING AND BEDREST ON PERFORMANCE AND MOOD.

THE OHIO STATE UNIVERSITY, PH.D., 1979
EFFECTS OF NAPPING AND BEDREST
ON PERFORMANCE AND MOOD

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By
Amy Dayle Bertelson, B.S., M.A.

****

The Ohio State University
1979

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Approved By

Advisor
Department of Psychology
ACKNOWLEDGEMENTS

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Daytime napping and bedrest effects on awake behaviors. Paper to be presented at the meeting of the Society for Psychophysiological Research, Cincinnati, October, 1979.
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INTRODUCTION

Much is known about the physiology of sleep and although the need for sleep is obvious, the manner in which sleep is most efficiently obtained is unclear. Most people obtain their sleep quota in one consolidated nighttime period; nevertheless, a monophasic nocturnal schedule of sleep may not be in all circumstances the most efficient biologically. Recently, the effects of sleep-wake cycle variations and fragmented sleep have been examined, but the role of daytime napping in fulfilling sleep requirements has received very little attention.

Children, ages 1 and 2, obtain 12% of their sleep during daytime naps (Reynolds & Mallay, 1933). From ages 3-5, the amount of nighttime sleep remains the same, while daytime naps decrease until approximately age 5 when naps are dropped completely (Webb, 1975). As one matures, social factors force the sleep process into a monophasic pattern of consolidated nighttime sleep (Rechtschaffen, 1971; Taub, 1977). Although in some cultures, especially tropical areas, biphasic sleep is common (Johnson, Naitoh, Moses, & Lubin, 1977; Webb, 1975). For example, the afternoon "siesta" is enjoyed by many Mexican adults (Taub, 1971). In this country, however, napping as an afternoon rite is uncommon, although napping frequency does increase with people over 60 years old (Tune, 1968; 1969; Webb, 1975), and some researchers attribute decreased social pressures as partially responsible (Taub, 1977).
Frequency of napping. A recent symposium at the American Psychological Association was entitled "Who needs a 24-hour day? Efficiency of napping and fragmented sleep" (Williams, 1976). This symposium was unique in that multiphasic sleep, in particular naps, has received very limited attention even though many people do indeed nap. The most frequently surveyed domain has been the university campus with Lawrence and Shurley (1972) reporting that napping among college students is not uncommon. At the University of Florida, 84% of the questioned students (N = 89) took at least one nap in a two-week period (Webb, 1975). More frequent naps, one or more per week, were taken by 51.5% and 53% of the subjects in two separate studies (Johns, Gay, Goodyear, & Masterton, 1971; Lawrence & Shurley, 1971). In a more recent study, 60% of 430 students said they napped sometimes, usually, or always, while 40% reported that they rarely or never napped (Evans, Cook, Cohen, Orne, & Orne, 1976; 1977). Thus, for many college students, napping is an important part of their daily sleep allotment.

Function of napping. An obvious function of napping is to replace previously lost sleep or to extend final nighttime retiring. Yet for some, a brief nap may have recuperative effects that far exceed the actual time asleep. In contrast, the aftermath of napping for others is so unpleasant that it is avoided. From an analysis of questionnaire data, Evans et al., (1976; 1977) identified two types of nappers: replacement nappers who nap to make up for previously lost sleep, and appetitive nappers who nap for reasons other than sleep need and "apparently derive psychological benefits from the nap not directly related to the physiology of sleep" (Evans et al., 1977, p. 687), e.g.,
relief from stress or boredom. The actual nap-sleep patterns for these two types of nappers differed such that the sleep of replacement nappers looked similar to early nighttime sleep, while the appetitive napper's sleep fluctuated between drowsiness and light sleep.

In an attempt to discover biological functions of napping, Lawrence (1976) suggested that sleep cycles during naps be examined.

**Sleep staging.** The distribution of sleep stages in normal adults during nighttime sleep was first described by Williams, Agnew, and Webb (1964; 1966). Sleep is divided into five stages called 1, 2, 3 and 4 (collectively labeled NREM) and REM, or rapid eye movement sleep. Stage 1 consists of low-amplitude mixed-frequency EEG activity; Stage 2 is similar but also contains K-complexes (rapid, high-amplitude, spike-like waves) and bursts of sleep spindles (12-14 Hz sigma rhythms). Delta sleep (stages 3 and 4 combined) is described as high-amplitude slow waves of 1-2 Hz, with the only difference between stages 3 and 4 being the amount of high amplitude, slow wave activity. During REM sleep there is a low-amplitude mixed-frequency EEG similar to Stage 1, but accompanied with rapid eye movement bursts and decreased muscle tonus.

Nighttime sleep is generally composed of four to six 90-minute NREM-REM cycles. The first third of nocturnal sleep is essentially delta sleep (stages 3 and 4) while the last third of the night consists of Stage 2 and REM sleep. Nap sleep, on the other hand, is not a miniature version of nighttime sleep (Johnson, Naitoh, Moses, & Lubin, 1977). The type of EEG pattern seen during napping depends on when the nap is taken and how long the nap lasts. Studies have shown that REM sleep occurs predominantly during morning naps, suggesting that napping at
this time is an extension of the final third of normal nighttime sleep. Afternoon and evening naps have a prevalence of stage 4 sleep, suggesting that late-in-the-day napping resembles the first third of a normal night's sleep (Karacan, Finley, Williams, & Hursch, 1970; Maron, Rechtschaffen, & Wolpert, 1964; Webb & Agnew, 1967; Webb, Agnew, & Sternthal, 1966). Similarly, others (Evans et al., 1976; 1977) have reported that people who nap to replace lost sleep have afternoon sleep patterns resembling those seen early in the night -- a finding which seems consistent with replacement napper's main reason for napping. Although on the other hand, if the lost sleep (being replaced by napping) was due to early morning awakening, and consequently decreased REM time, then one might expect more REM sleep during replacement naps. Indeed, REM sleep may have occurred if nappers had been allowed to nap longer since REM onset is usually dependent on NREM sleep length -- see next section for further discussion.

Thus, EEG patterns during naps seem to depend on the proximity of the nap to the onset or termination of the regular nighttime sleep period. Some investigators maintain that the longer the subject has been awake, the greater the tendency for stage 4 to occur and for REM sleep not to occur during naps (Webb, 1969; Webb & Agnew, 1967).

**Nap length and REM.** These findings certainly do not exclude the possibility of REM sleep occurring during afternoon naps. It appears that the longer one naps, the more likely some REM sleep will occur. Data from Taub et al. revealed REM sleep in a 2-hour nap but not in a \(\frac{1}{2}\)-hour nap (Taub, Tanguay, & Clarkson, 1976; Taub, Tanguay, & Rosa, 1977). Lawrence (1976) demonstrated similar results with a mean
latency to REM onset in naps of 68.8 minutes. Another study found 53 minutes to be the shortest interval between sleep onset and the first REM period (Maron et al., 1964).

With the possible exception of REM sleep, the effect of afternoon nap length on sleep stages is basically negligible. Comparing \(\frac{1}{2}\)-hour, 1-hour, and 2-hour naps, Lawrence (1976) found no difference in percentage of sleep stages other than for REM sleep with longer naps (> 64 minutes) containing more REM than shorter naps. Interestingly, naps containing REM sleep were experienced as subjectively different (better) than naps containing no REM (Lawrence, 1976).

Many people do report dreaming during short naps and often times immediately after falling asleep. Maron et al. (1964) stated that REM periods at sleep onset occur very rarely in daytime naps of normal subjects. They explained that "dream-like" activity can occur during descending stage 1 (Maron et al., 1964), and Greenhouse (1974) stated that dreaming during naps is more characteristic of the "thinking" kind of mental activity. Nevertheless, laboratory recorded naps are all "forced" naps, whereas spontaneous naps are presumably taken when one feels a need for sleep -- and possibly a need for REM. Consequently, spontaneous naps may contain more REM than laboratory naps and may even begin with REM, especially if REM deprivation has occurred on the previous night. As in-home recording equipment becomes more feasible, the unknown effects of "forced" naps can be eliminated.

Effects of naps on nocturnal sleep. Subjects deprived of stage 4 or REM sleep have demonstrated a "rebound" effect on recovery nights consisting of increased amounts of both stages (Agnew, Webb, & Williams, 1964; Dement, 1960). These results were interpreted as indicating that
A constant amount of stage 4 and REM sleep is needed each night. Since these stages occur in different amounts during daytime naps (REM in morning naps; stage 4 in afternoon naps), it would seem reasonable to investigate what effect napping has on nocturnal sleep stage distribution. One such study found that afternoon naps with stage 4 reduced the amount of stage 4 in the subsequent night’s sleep -- indicating that stage 4 sleep during naps partially fulfills the nightly stage 4 quota. On the contrary, morning naps with REM demonstrated no effect on nighttime sleep, suggesting that morning naps do not serve any biological purpose. These results may explain why morning naps are rarely taken voluntarily (Karacan, Williams, Finley, & Hursch, 1970).

For some, the effects of afternoon napping on nocturnal sleep are deleterious. Habitual nonnappers asked to take an hour-long afternoon nap, exhibited more difficulty falling asleep and maintaining their sleep on the night following napping (Evans et al., 1976). Hence, some of the consequences of afternoon napping are disruptive to nighttime sleep.

Effects of naps on daytime functioning. Although many studies have investigated EEG patterns of naps, the behavioral consequences of napping have not been clarified. Some behavioral studies of napping have examined the sleep-replacement-ability of naps after partial sleep deprivation and/or sleep-wake cycle disruption\(^1\). One such study involved a 220-minute cycle of 60-minutes of either napping, bedresting, or bicycling, and 160-minutes of awake time for 10 epochs (Lubin, Hord, Tracy, & Johnson, 1976). During awake time, subjects were administered a number of performance tasks and measures (auditory, addition, and word
memory tasks, oral temperature, and sleepiness scales) to determine if any of the 60-minute treatment conditions could compensate for loss of nocturnal sleep. Results established nappers as having slept approximately 3.7 hours per 24 hours or 61% of the available sleep time. A slight decrement was exhibited by the nap group on auditory and addition tasks. The bedrest group showed more decrement than nappers with exercisers producing the most significant sleep loss effect. Comparatively, the bedrest group showed significantly more impairment than the nap group on only the addition task. Lubin et al. (1976) interpreted their results as demonstrating that bedrest is not a substitute for sleep and that exercise increases performance decrement due to sleep loss.

Nappers in this same study (Lubin et al., 1976) reported feeling significantly more sleepy after napping than before. Whereas nappers in another study, whose sleep-wake cycles were not disrupted, reported improved ability to function and a feeling of less fatigue after 1-hour naps (Evans et al., 1976). The effects of partial sleep deprivation and sleep-wake cycle disruption most likely interfere with elucidating the effects of napping on awake behavior. In the Lubin et al. (1976) study, nappers showed less decrement than bedresters or exercisers on performance scores after sleep deprivation and disruption, but nappers only performed significantly better than bedresters on one task.

Only a few studies have examined the effects of naps on performance and mood without intentionally disrupting the previous night's sleep (Taub, 1977; Taub, Tanguay, & Clarkson, 1976; Taub, Tanguay, & Rosa, 1977). In these studies, 18 male university students who reported regularly napping, were brought to the sleep laboratory on three
different afternoons for two experimental conditions consisting of a 3/4-hour nap and a 2-hour nap, and a control condition of no nap with each subject serving as his own control. Subjects completed a 10-minute auditory reaction time task (performance measure) and two self-report inventories (mood measure) 20 minutes before and after each of the three conditions. Results demonstrated improved performance and mood with the napping conditions relative to the control. Length of nap or sleep stage duration appeared to have no effect on the dependent variables; hence, Taub et al. assumed that increased efficiency with napping was a general consequence of the occurrence of sleep itself and not contingent upon sleep duration or any specific sleep stage. Since nap length and sleep stage time appeared not to be responsible for improved performance and mood, then one may ask if improved efficiency after a nap was due to the act of sleeping or was it due to bedrest and relaxation. In other words, would subjects who rest in bed but not sleep also show improved performance and mood? Although Taub et al. had a control group, their subjects read during the rest period. The only other study that has investigated the effects of bedrest on performance is the Lubin et al. (1976) study which clearly involved sleep deprivation.

The purpose of this study was to examine the effects of nap taking (sleeping) and bedrest (not sleeping) on performance and mood. A similar auditory reaction time task as that used by Taub et al. was utilized in this study in conjunction with two other tasks, visual reaction time and an addition task comparable to that used in the Lubin et al. (1976) study. Since it would seem difficult for an accustomed napper to remain awake during a bedrest session, this study used a
control group of habitual nonnappers (bedresters) who were asked to bedrest but not sleep.

The specific hypotheses for this study are
I. Performance and mood measures after napping will be significantly better than pre-nap scores for nappers.
II. Nonnappers (bedresters) will show significantly better performance and mood scores after bedrest than before bedrest.
METHOD

Subjects

Forty male and female university students from Introductory Psychology classes were selected as subjects. They were initially screened with a modified version of the Cornell Medical Health Index (Gunderson & Arthur, 1969, see Appendix A) and a brief sleep questionnaire (see Appendix B). Selected subjects were those whose responses were not indicative of disturbed sleep, medical problems, psychiatric disorders, and frequent alcohol or other drug usage. Subjects also had to report consistently sleeping 7-8 hours nocturnally. Those 20 students who reported napping in the afternoon for \( \frac{1}{2} - 2 \) hours at least three times per week over the preceding year were assigned to the Experimental Group (Nappers). The Control Group (Bedresters) consisted of 20 students who reported that they had seldom or never napped (e.g., less than one nap per week) during the past year. Subjects were "paid" for participating in this study with three hours of experimental credit for psychology courses. All selected subjects were asked to take the Minnesota Multiphasic Personality Inventory (MMPI) in order to investigate the possibility of any significant personality differences between groups. An extended sleep questionnaire (see Appendix C) was given to each subject so that information about napping and nighttime sleep parameters could be examined.
Measures of Performance and Mood (Dependent Variables)

Although some studies have used only one auditory reaction time task as a measure of performance (Taub, 1977; Taub, Tanguay, & Clarkson, 1976), this study used three measures of performance: auditory reaction time and two other tests designed to measure visual reaction time and cognitive functioning. The Stroop Color-Word Test (Stroop, 1935) served as the visual performance task and an addition task (Taub & Berger, 1974) determined cognitive functioning.

Mood was assessed by the Activation-Deactivation Adjective Check List (AD ACL) as used by Taub, Tanguay, and Clarkson (1976) and by the Multiple Affect-Adjective Check List (MAACL) (Zuckerman & Lubin, 1965).

Auditory reaction time. Seventy-five auditory stimuli were generated by a Wide Range oscillator (model 200 CD) and recorded on a Sony model TC-270 stereo tape recorder. Each stimulus on the tape triggered an electronic voice relay (C.H. Stoelting Co., Chicago, Illinois, Cat. No. 17222) which in turn started the Klockounter timer (Hunter Manufacturing Co., Iowa City, Iowa, model 120C) which recorded reaction time in 1-msec units. The subject's task was to stop the timer. Subjects were seated and instructed to press a switch, held in the preferred hand, immediately whenever they heard an auditory signal. The reaction time stimulus was a 1-kHz tone, 300 milliseconds in duration, presented at 70.5-dB (SPL) intensity. The mean interstimulus interval was four seconds with a variation of ±2 seconds; the duration of the entire task was six minutes. Measure of performance was the mean reaction time for the entire task. A three trial practice session was presented before the actual task was begun.
**Visual reaction time.** The Stroop Color-Word Test is a set of color names written in a color different than the color name (e.g., the word red written in green ink). The subject's task was to name the colors in which the words were written as quickly as possible while ignoring the words themselves. Only blue, green, and red were used, presented in random order with two parallel forms consisting of different arrangements. Order of list presentation was counterbalanced among subjects; no subject saw the same list twice. Color names were presented on 20 5x7 cards which the subject held. Performance measure was the total time from start to finish of the list. Two example cards were given before testing to make sure the subject understood his/her task.

**Addition task.** The five-minute addition task consisted of 40 pairs of two-digit numbers presented every four seconds from a tape recording. Subjects were instructed to add each pair mentally and write their answers on a sheet of paper with five columns of blank spaces. At the end of each minute the tape recording told the subject to shift to the next column. Two different tapes were used with their order of presentation counterbalanced among subjects. The performance measure was the percentage of problems correctly added. A short practice session of three trials was allowed before actual testing.

**Mood.** The Activation-Deactivation Adjective Check List is a list of 50 adjectives to which subjects respond as they feel at the moment (see Appendix D). Each word was scored on a 4-point scale: 1 (definitely do not feel), 2 (cannot decide), 3 (feel slightly), and 4 (definitely feel). The AD ACL has been factor analyzed into four factors: General Activation, Deactivation-Sleep, High Activation, and General Deactivation.
Scoring of the AD ACL consisted of a mean score for each of the four factors for each subject.

The Multiple Affect Adjective Check List consists of 132 adjectives (see Appendix E). Respondents were to check those adjectives which described their current feelings. All items were keyed either plus (+) if checked or minus (-) if not. There are three scales -- Anxiety, Depression, and Hostility; scores for each scale were computed separately by summing the number of plus items and the number of certain keyed items not checked.

**Design**

The experiment consisted of one afternoon session per subject with two subjects run simultaneously. Napping behavior was operationally defined as five consecutive minutes of stage 2, 3, or 4 sleep (as scored by Rechtschaffen & Kales, 1968, criteria). Any experimental subject who met this criterion qualified as having taken a nap in the sleep laboratory and thus fulfilled the experimental condition. Control subjects were asked to lie in bed and rest but not fall asleep. Falling asleep or sleep onset was defined as three consecutive minutes of stage 1 sleep or the appearance of sleep spindles and/or K-complexes. No adaptation period was provided for either experimental or control subjects. One experimental subject who was not able to fall asleep and five controls (bedrester) subjects who did fall asleep (as determined by polygraph records) were disqualified from the study. Consequently a total of 46 subjects were run in order to have 20 subjects in each group. Eight of the 20 qualifying bedrester subjects had to be aroused once during bedrest via intercom since their sleep records indicated they were entering stage 1 sleep.
Sex and age in each group were controlled for as much as possible. The experimental group (nappers) had 11 females and nine males, mean age was 22 with a range of 18-32. Nine females and 11 males comprised the control (bedrest) group with a mean age of 24 and a range of 18-32. Marital status and nighttime sleeping arrangement (presence of another in the same bed or room) was identical for each group.

Procedure

Subjects were instructed to sleep at home their usual number of hours and to refrain from alcohol or drug consumption on the night preceding the experiment. They were also asked to refrain from drinking coffee, tea, or colas, or taking naps on experimental days. Otherwise, they were to maintain their usual physical activity and food and fluid intake.

For all conditions subjects reported to the sleep laboratory in Upham Hall, Ohio State University Hospital, at 1:00 or 1:30 P.M. MMPI and the extended sleep questionnaire were collected from the subject. After a consent form (see Appendix F) was signed, the tasks were begun (see procedure outline, Appendix H). The performance and mood measures were administered approximately 15 minutes before and after each condition (nap or bedrest). Tasks were presented in the following order: auditory reaction time, addition task, Stroop visual task, AD ACL, and the MAACL. Subjects were not informed about their performance in order not to influence mood ratings. The mood scales were administered after rather than before the behavioral tasks to minimize the possibility that performance might be affected by cognitive set.
After the first set of tasks, a registered EEG technician measured the subject's head and placed Grass (E5H, gold) electrodes with collodion for recording electroencephalographic (C4-A1, C3-A2, O1-A2, O2-A1), electromyographic (chin), and electrooculographic (E1-A2, E2, A1) activity. These parameters were recorded by a Grass 78 EEG Polygraph Date Recording System for both nappers and bedresters and scored for sleep stages by 30-second epochs according to standard criteria (Rechtschaffen & Kales, 1968).

The experimental subject (napper) was asked to go to sleep and take a nap. The control subject (bedrester) was told to lie in bed and relax, but not to fall asleep. All subjects were allowed to nap or bedrest for one hour (approximately 1:30-2:30 P.M. or 2:00-3:00 P.M.) and all time cues (clocks, watches, daylight, etc.) were eliminated. After an hour, subjects were aroused and electrodes were removed. Afterwards, subjects had an opportunity to stretch, walk around, etc., until the second set of tasks was begun.

Data Analysis

Multivariate analyses of variance which tested for group, time of measurement, and time by group effects were used to analyze the response measures. Variables were grouped together in a multivariate according to the numerical dimension of the subjects' responses, i.e., the three performance measures were in one analysis, the four factors of the AD ACL in another, and the three scales of the MAACL in a third analysis. Significant multivariate effects were followed-up by univariate tests (split-plot repeated measures design, see Kirk, 1968). These procedures reduced the number of errors encountered when doing many univariate tests. The .05 level of significance was adopted in all significant tests.
RESULTS

As shown in Table 1, no main effects or interactions for the multivariate analyses of the performance measures (auditory, addition, and Stroop tasks) were significant.

The MANOVA for the AD ACL demonstrated a significant main effect for time of measurement (pre and post). The corresponding univariate tests showed a significant main effect of time for two factors, High Activation and General Deactivation (see Table 2). As shown in Figure 1, the scores for the High Activation factor decreased from pre to post for both groups, whereas the scores for General Deactivation increased from pre to post.

Data from the multivariate analyses of the MAACL are reported in Table 3. The MANOVA produced a significant main effect for groups (nappers and bedresters) as well as a significant main effect for time of measurement. Univariate tests for all three scales, Depression, Hostility, and Anxiety, demonstrated a significant main effect of group. In addition, a significant main effect for time of measurement was found for the Anxiety scale (see Table 3).

Mean scores (Table 4) on the Depression, Hostility, and Anxiety scales show bedresters to have higher scores than nappers regardless of time of measurement. Hostility scores for bedresters showed greater decreases from pre to post than for nappers, and both groups decreased their anxiety scores over time (see Figure 2). Depression scores decreased slightly for bedresters, whereas nappers increased slightly from pre to post.
Table 1

Performance Measures*

Multivariate Analysis of Variance Summary Table

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*auditory reaction time, addition task, Stroop Color-Word Test
Table 2

Activation-Deactivation Adjective Check List
Multivariate Analysis of Variance Summary Table

Multivariate Tests

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<td>12.486</td>
<td>.001*</td>
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<td>.645</td>
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<td>Gen Deact</td>
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<td>.559</td>
<td>6.360</td>
<td>.014*</td>
<td>.073</td>
<td>.788</td>
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*Statistically significant
Figure 1  Pre to Post Changes for High Activation and General Deactivation
Table 3
Multiple Affect Adjective Check List
Multivariate Analysis of Variance Summary Table

Multivariate Tests

<table>
<thead>
<tr>
<th>Effect</th>
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<tr>
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<td>.002*</td>
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<tr>
<td>Time (T)</td>
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<td>.009*</td>
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Univariate Tests

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<th>Signif. of F</th>
<th>GxT</th>
<th>Signif. of F</th>
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</thead>
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<tr>
<td>Hostility</td>
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<td>.011*</td>
<td>.770</td>
<td>.383</td>
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<tr>
<td>Depression</td>
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<td>.005</td>
<td>.942</td>
<td>.036</td>
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<td>.001*</td>
<td>4.38</td>
<td>.04*</td>
<td>.274</td>
<td>.602</td>
</tr>
</tbody>
</table>

*Statistically significant
Table 4
Mean Scores for Performance and Mood Measures

| Measures | Hapners | | Bedresters | |
|----------|---------|----------------|----------------|
|          | Pre     | Post          | Difference*    | Pre     | Post          | Difference*    |
|          | Mean SD | Mean SD       | Mean SD        | Mean SD | Mean SD       | Mean SD        |
| Auditory | 27.55 2.64 | 27.45 3.20 | -.10 3.12 | 28.00 2.24 | 27.25 2.19 | -.75 1.74 |
| Addition | 50.40 27.38 | 56.90 27.24 | 6.50 6.10 | 60.95 22.76 | 63.95 24.46 | 3.00 10.03 |
| Stress   | 22.90 4.93 | 20.85 3.06 | -2.05 4.60 | 20.40 3.53 | 19.05 3.42 | -1.35 2.53 |
| Gen Act  | 2.62 .90 | 2.61 .86 | -.01 .95 | 2.52 .78 | 2.05 .80 | -.47 1.11 |
| Post-Sleep| 2.83 .36 | 2.39 .43 | -.14 .50 | 2.46 .59 | 2.62 .51 | .15 .57 |
| High Act | 2.46 .93 | 1.73 .58 | -.73 .98 | 2.32 .85 | 1.76 .87 | -.56 .49 |
| Gen Rest | 2.73 .71 | 2.64 .68 | -.35 .67 | 2.15 .61 | 2.59 .79 | .44 .72 |
| Anxiety  | 5.85 4.19 | 4.35 3.21 | -1.50 2.64 | 9.55 5.33 | 7.05 4.07 | -2.50 3.77 |
| Depression| 9.40 6.03 | 9.60 5.65 | .20 3.00 | 16.40 9.69 | 15.95 8.56 | -.45 8.08 |
| Hostility| 5.25 3.59 | 5.10 3.22 | -.15 2.81 | 9.35 8.02 | 7.35 5.69 | -2.00 6.06 |

* pre scores subtracted from post scores
Figure 2 Pre to Post changes for Hostility and Anxiety Scales
Figure 3 Pre to Post Changes for Depression Scale
MMPI analyses. T scores with K corrections were analyzed with t-tests for each of the 12 basic validity and clinical scales of the MMPI. (Scale 5, masculinity-femininity, was eliminated from all analyses since male and female scores were combined). No significant differences were found for any scale.

Analysis of MMPI results by number of scale scores elevated at T ≥ 70 and by two-point code types (two highest scales per subject) were similar for each group. For nappers, 60% had one or more scale scores elevated at 70 or greater compared to 50% of the bedresters. The most frequently elevated scales for nappers were scale 9, hypomania, (50%), scale 4, psychopathic deviate, (40%), scale 2, depression, (25%), scale 7, psychasthenia, (25%), and scale 8, schizophrenia, (25%). Fifty-five percent of the bedresters also showed their highest elevation on scale 9 in addition to 30% on scales 4 and 7 respectively, 35% for scale 8, and 20% elevated scale 2. The most frequently obtained two-point code types for both groups were 4-9/9-4 (25% nappers; 15% bedresters) and 8-9/9-8 (15% nappers; 20% bedresters).

Although nappers more often than bedresters elevated scale 4 and more bedresters than nappers elevated scale 8, these differences were not significant. Overall, the MMPI produced no outstanding personality differences between nappers and bedresters.

Sleep parameters for nappers. The mean latency to sleep onset was 13.17 minutes with a range of 3 to 47 minutes. The mean total sleep time for nappers was 36.89 minutes; the shortest nap was 13 minutes while the longest nap was 58.5 minutes. Nappers spent the majority of their sleep time in stage 2 sleep -- mean stage 2 time was 22.97 minutes, while the
mean for stage 1 was 10.47 minutes. Nine subjects entered stage 3 sleep (mean for nine subjects = 4.8 minutes); three of those subjects also had stage 4 sleep (mean for three nappers = 7.5 minutes). Sleep stage characteristics are summarized in Table 5.
### Table 5
Comparison of Sleep Patterns During Afternoon Naps

<table>
<thead>
<tr>
<th></th>
<th>This Study (N=20)</th>
<th>Taub et al., 1976 (N=18)</th>
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<tbody>
<tr>
<td></td>
<td>Mean # of minutes</td>
<td>% TST</td>
</tr>
<tr>
<td>TST</td>
<td>36.89</td>
<td></td>
</tr>
<tr>
<td>Stage 1</td>
<td>10.47</td>
<td>23.38</td>
</tr>
<tr>
<td>Stage 2</td>
<td>22.97</td>
<td>62.27</td>
</tr>
<tr>
<td>Stage 3</td>
<td>2.26</td>
<td>6.13</td>
</tr>
<tr>
<td>Stage 4</td>
<td>1.18</td>
<td>3.20</td>
</tr>
<tr>
<td>REM</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

TST: Total Sleep Time; REM: Rapid Eye Movement
Questionnaire Results

Nighttime sleep parameters. Both nappers and bedresters classified themselves as being very good or moderately good sleepers on the extended sleep questionnaire. Bedtime for both groups fell between midnight and 1:00 A.M. with morning awakening times showing more variability. Bedresters sleep slightly longer (7.1 hours) than nappers (6.8 hours), but both groups report they would prefer 7.9 hours of sleep. In addition, bedresters more often than nappers felt they had not slept enough. Nappers report more awakenings during the night than bedresters and take longer to fall asleep after awakining, but these differences were not statistically significant. Basically, nappers and bedresters did not differ in their reported nightly sleep patterns.

Evans et al. (1976) report that one characteristic of nappers is their volitional control over sleep processes, i.e., they can fall asleep easily and in an array of circumstances. Indeed, nappers in this study reported falling asleep more frequently than nonnappers in a variety of situations: on long car trips, while reading a book or studying, while watching television, a play, or a movie, and after a good meal. Interestingly, 65% of the nappers reported they could fall asleep at times of stress, whereas only 25% of the nonnappers could do so.

Nap characteristics. Nappers reported taking 3-6 naps a week with a mean of 4.2 naps. They prefer to nap around 2:30 P.M. and consequently describe themselves as being most tired and sleepy at this time. Improved ability to concentrate and study after napping is endorsed by 70% of the nappers, with peak efficiency times occurring before noon or after 6:00 P.M.
The ideal nap length for the subjects in this study was 109 minutes, with the longest nap at 174 minutes, the shortest nap at 34 minutes, and their typical nap at 90 minutes. They estimated an average of 12.2 minutes to sleep onset during a nap. Interestingly, their reported mean latency for nighttime sleep was nearly twice as long, 22.2 minutes.

Nearly all of the nap subjects consider their naps to be satisfying with 85% wishing they could nap every day. Half of the nappers would prefer several short naps throughout a 24-hour day, rather than a continuous night's sleep.

Twenty-five percent of the nappers said they napped even when they did not feel tired. This percentage is comparable to findings in a larger questionnaire study (Evans et al., 1976) in which 30% of the nappers stated they napped for reasons other than a need for sleep.

Nonnap characteristics. On the extended questionnaire, nonnappers were asked why they did not nap. The major reasons given were 1) no time available; 2) napping interferes with work, studying, or leisure entertainment; and, 3) resting without falling asleep is more beneficial. Nonnappers did not think napping was unpleasant and/or produced undesirable physical or mental after-effects. In contrast, the nonnappers in the Evans et al. (1976) study were chosen specifically because they considered napping to be an unpleasant experience.
DISCUSSION

Overall, the treatment condition of napping or bedrest had no differential effect on the two groups. Both nappers and bedresters showed significant changes from pre to post on the Anxiety scale of the MAACL and on two factors, High Activation and General Deactivation, of the AD ACL. Scores decreased from pre to post for both groups on the Anxiety scale, characterized by such terms as afraid, nervous, worried, upset, etc. In addition, scores decreased pre to post on the High Activation factor (described by tense, jittery, fearful, etc.), while the General Deactivation factor which consisted of descriptors such as calm, at-rest, leisurely, etc., showed increased scores. These findings clearly suggest that one major consequence of both napping and bedrest is relaxation and reduced anxiety.

Thus, the hypotheses for this study -- that both nappers and bedresters would show improved scores after treatment -- were supported for selective tasks. Scores on the mood measures showed improvement from pre to post, while performance measures did not change. Even though other studies have demonstrated that reaction time performance is sensitive to sleep disruptions (for example: Lisper & Kjellberg, 1972; Lubin et al., 1976; Wilkinson, 1968), results from this study suggest that reaction time performance is not influenced by either napping or bedrest. Nevertheless, both napping and bedrest had a positive effect on mood, suggesting that sleep itself is not the crucial variable that changes mood.
It would seem to be "taking a break", "getting away from it all", and removing oneself from the tension of the day, that helps decrease negative affect.

The significant main effect of group for the three MAACL scales demonstrates that scores for bedresters and nappers differed regardless of time of measurement. Interestingly, bedresters had higher scores than nappers on both pre and post measures for all three scales, Anxiety, Depression, and Hostility, even though both groups showed decreased scores from pre to post measurements (see Table 4). The one exception was the Depression scale on which nappers increased slightly from pre to post.

Affective differences. These results demonstrate that, on the MAACL, bedresters expressed significantly higher levels of anxiety, hostility, and depression than nappers. A reasonable question is why did bedresters show higher negative affective levels than nappers? Examination of MMPI findings do not explain this difference since MMPI results were very similar for both groups. In addition, the MMPI is a trait measure, whereas the "Today" form of the MAACL is a transient state measure. Presumably, the MAACL scores reflect current affective states and not necessarily personality styles and/or psychopathology.

Higher overall affective levels for bedresters may be the result of not habitually napping. Nap taking may serve as a coping mechanism providing temporary escape or withdrawal from daily distress. Indeed, other studies have found people who nap for psychological (and non-sleep) reasons, and who report post-nap benefits that exceed actual sleep time (Evans et al., 1976). Perhaps with experience and time, habitual nappers
have been able to use napping as a way to initially lower and maintain decreased levels of daily affective distress. At least in this study, nappers who had been accustomed to napping three or more times per week over the past year, had lower MAACL scores than bedresters from the onset -- possibly because of their regular napping schedule.

Yet results show that a nap, as measured in this study, is no more beneficial than comparable bedrest, since both treatment conditions produced increased relaxation scores and decreased anxiety scores. Hence, at least for this study, it would seem not to matter if one falls asleep and naps, or whether one just lies in bed and rests. Both conditions provide relaxation and improved affect. Consequently, napping (sleeping) per se, is probably not the key to lower negative affect, but rather the act of "taking a break" and relaxing -- in the form of either napping or bedresting -- serves to lower affect, perhaps both immediately and over time. Bedresters in this study were not habitual bedresters and, therefore, not accustomed to taking "bedrest breaks". Perhaps if bedrest subjects were to become habitual bedresters and/or nappers, their daily negative affect level would be lowered over time and eventually resemble pre-treatment scores for nappers.

Most likely though, bedresters would choose bedresting and not napping as a way to relax since their high level of affective distress probably interferes with ability to nap. In fact, 40% of the bedresters stated on the sleep questionnaire that they did not nap because they knew they would not be able to fall asleep. In addition, only 25% of the bedresters said they could fall asleep during times of stress, whereas 60% of the nappers reported being able to do so. One might
suspect that if level of affect interferes with ability to nap, then falling asleep at final, evening bedtime would also be difficult. This suspicion is not confirmed, at least not by questionnaire data, as bedresters reported a mean of 16.7 minutes to nighttime sleep onset, while nappers reported a higher mean of 22.2 minutes. Although these means are subjective estimates and not actual laboratory findings, it is, nevertheless, possible that affective levels for bedresters do interfere with ability to nap (and choosing to nap) without affecting nighttime sleep.

Results from this study show significant affective differences between nappers and nonnappers with nonnappers scoring higher both pre and post treatment on Anxiety, Hostility, and Depression scales. Further research, using a different sample of habitual nappers and nonnappers and investigating additional measures of state affect, would help clarify whether there are indeed different levels of affect between people who regularly nap and people who do not nap. Also, it would be interesting to compare habitual nappers with habitual bedresters to investigate whether their affective levels are similar. Unfortunately, habitual bedresters may be difficult to find since it would seem that most people either lie down to nap or they do not lie down at all.

Discrepancy with Other Studies

Although this study found both nappers and bedresters had improved scores after treatment, other studies using nappers and controls have not found similar results. Taub et al. (1976) compared nappers (with two different nap lengths) to a control (bedrest) group of the same nappers who sat in bed and read magazines. They found scores improved for both
nap lengths relative to the control scores, on a 10-minute auditory reaction time task, on three factors of a shortened AD ACL, General Activation, Deactivation-Sleep, and General Deactivation, and on three subscales labeled Inert-fatigued, Energetic, and Tense-anxious, of another adjective checklist.

Perhaps differences in sleep length or sleep stage duration could account for the fact that nappers in the Taub et al. study showed greater improvement over the control, while nappers in this study improved the same as control subjects. Yet, sleep parameters for both studies were very similar. Nappers in this study slept a mean of 36.89 minutes or 61.5% of the available nap time was spent sleeping which is comparable to the Taub et al. (1976) study where nappers slept 30.39 minutes. In addition, sleep stage distribution for both studies was very similar as evidenced in Table 5. The majority of nap time for all subjects was spent in stages 1 and 2, a finding also reported in other studies (Evans et al., 1976; 1977; Lawrence, 1976).

Some investigators (Johnson, 1973; Taub & Berger, 1974; 1976a; 1976b) have hypothesized from their research that "behavioral and psychological functions are not directly contingent upon sleep duration or any specific sleep stage" (Taub et al., 1976, p. 215). Hence, length of sleep or sleep stage duration would appear to have little effect on performance and mood and, therefore, not explain the differing results from the two studies.

Nevertheless, there were some major differences between this study and the Taub et al. (1976) study that may account for the differing results: 1) different types of control groups; 2) different tasks
during the nonnap treatment condition; and, 3) use of EEG monitoring of controls. Taub et al. used the same subjects, habitual nappers, in both the experimental and the control group, i.e., each subject served as his own control. These control subjects were asked to sit in bed and read magazines for two hours while "the experimenter checked on them frequently to ensure that they did maintain an alert, wakeful state" (p. 212). In contrast, control subjects in this study were habitual non-nappers who lay in bed awake for one hour (with lights off), and who had the same electrode placements and recordings as the nappers. Electrodes were placed on bedresters not only to maintain identical treatment conditions for both groups, but also to record and to monitor EEG, EOG, and EMG in order to verify by stringent criteria that bedresters did not spend any time asleep.

Taub et al. (1976) found that nappers with accustomed nap schedules showed improved performance and mood scores on selective measures after napping when compared with their scores after the unaccustomed, and possibly aversive, activity of not being allowed to nap, hence resting/reading. In contrast, this study compared nappers after sleeping to nonnappers after resting and found both groups improved on selective tasks with no group scoring significantly better than the other. As evidenced by Taub's et al. results, habitual nappers may indeed derive more benefit from their regular routine of napping than from the irregular nap-replacement activity of resting/reading. One might conclude that napping is more beneficial than bedrest. But these results suggest that napping is more beneficial than resting/reading for habitual nappers only. Results from this study demonstrate that bedrest for habitual
nonnappers is just as beneficial as napping is for habitual nappers. Bedrest subjects derived the same improvements in positive affect after bedresting as nappers did after napping. In other words, bedresters did not have to sleep in order to benefit from lying down. But, just as the habitual napper does not do as well after resting as she/he does after napping, the habitual nonnapper may not do as well after napping as she/he does after bedresting. A study designed in which habitual nonnappers would take naps, could assess the effects of nap sleep on people who are not accustomed to sleeping at any time other than normal nightly bedtime. Researchers have hypothesized that any alteration in regular sleep-wake cycles will produce behavioral and psychological deficits (Taub & Berger, 1973; 1974; 1976b; Taub, Tanguay, & Clarkson, 1976). This, it would seem that nap taking for nonnappers would interfere with their daily performance and mood, but only more research can accurately answer this hypothesis. In addition, a control group of subjects who would be instructed to neither nap nor bedrest would help delineate the effects of the passage of time on situational negative affect.

Conclusion

In summary, both bedrest (not sleeping) and nap taking (sleeping) serve to significantly improve mood. Bedrest for habitual nonnappers is just as beneficial in increasing positive affect as napping is for habitual nappers. In this study in particular, nappers and bedresters showed significantly increased relaxation scores and significantly decreased anxiety scores after both napping and bedresting. Thus, it would seem that both resting in bed and/or sleeping are healthy mechanisms
for decreasing situational negative affect. These results were demonstrated only for habitual nappers and nonnappers, i.e., it is unclear what the results would be if habitual nappers were asked to bedrest and habitual nonnappers were asked to nap.

This study also demonstrated that there are significant affective differences between nappers and nonnappers with nonnappers having higher levels of negative affect than nappers. Perhaps one of the long-term effects of frequent napping or bedresting is decreased daily negative affect. The immediate and residual psychological benefits of regular napping and bedresting have yet to be fully explored.
LIST OF REFERENCES


Lawrence, B., & Shurley, J. Afternoon naps of different lengths. Psychophysiology, 1972, 9, 133.


Footnotes

1. Many studies have investigated the EEG patterns of naps taken as part of a disrupted sleep-wake cycle regime and/or of naps taken after partial sleep deprivation. Those studies not addressing behavioral effects of napping are not reported here. The interested reader is referred to the following studies: Carskadon and Dement, 1975; 1977; Johnson, Naitoh, Moses, and Lubin, 1977; Moses, Hord, Lubin, Johnson, and Naitoh, 1975; Moses, Naitoh, and Johnson, 1978; Webb and Agnew, 1974; 1975; 1977.

2. None of the MMPI profiles analyzed in this study were technically invalid by the $F-K > 11$ (raw score) criterion.

3. Interestingly, bedresters' MAACL scores were slightly higher than the normative scores for college students. College student norms were based on 44 males and 31 females with a mean age of 18.5 and a mean educational level of 13.4 years: Anxiety mean = 6.6, SD = 3.6; Depression mean = 14.2, SD = 7.1; Hostility mean = 7.9, SD = 3.9 (Zuckerman & Lubin, 1965). For comparisons, see Table 4.
Appendix A

Modified Cornell Medical Health Index

Name:                        Phone number:
Age:                        Sex:                        Date:

Instructions: Answer each question either yes or no.

1. Do you suffer badly from frequent severe headaches? __________
2. Have you fainted more than three times in your life? __________
3. Are you definitely underweight? __________
4. Do you usually have great difficulty in falling asleep or staying asleep? __________
5. Do you smoke more than 20 cigarettes a day? __________
6. Do you use alcohol or drugs excessively? __________
7. Do you drink more than six cups of coffee or tea a day? __________
8. Do you get nervous and shaky when approached by a superior? __________
9. Does your work fall to pieces when the boss or a superior is watching you? __________
10. Do you usually feel unhappy and depressed? __________
11. Do you often wish you were dead and away from it all? __________
12. Does worrying continually get you down? __________
13. Are you considered a nervous person? __________
14. Were you ever a patient in a mental hospital? __________
15. Does criticism always upset you? __________
16. Do sudden noises make you jump or shake badly? __________
17. Do frightening thoughts keep coming back in your mind? __________
Appendix B

Initial Sleep Questionnaire

Name: _______________________________ Date: _______

Age: ________ Sex: __________ Phone: ___________

Please answer each question.

1. How many hours of sleep did you have last night? _______
2. During the past year, how many hours of sleep have you regularly had? _______
3. How many hours of sleep would you like to have each night? ______
4. How many hours of sleep do you feel you need each night? ______
5. Do you sleep as deeply as you would like? Yes ______ No ______
6. Did you sleep well last night? Yes ______ No ______
7. Do you usually sleep well? Yes ______ No ______
8. Could you go to sleep now if you had the time? Yes ______ No ______
9. Do you consider yourself to be a good sleeper or a poor sleeper? (Circle one)

10. Do you take naps during the day? Yes ______ No ______
11. If so, approximately what time of day do you prefer to take your naps? ______
12. Over the past year, approximately how many times a week have you napped? ______
13. How long do your naps usually last? ______
14. Are you a non-napper? Yes ______ No ______
15. Over the past year, have you taken less than one nap a week? Yes ______ No ______
Appendix C

Sleep Questionnaire

Name__________________________________________________Age_______

Address_______________________________________Phone____________

Please circle or write in only one answer to each question.

1. Approximately how many times per week do you fall asleep within 5 minutes after going to bed? 0 1 2 3 4 5 6 7

2. Approximately how long does it take you to fall asleep after going to bed? Please estimate length of time to fall asleep in minutes ____________________.

3. Approximately how many times per week does it take you longer than 30 minutes to fall asleep after going to bed? 0 1 2 3 4 5 6 7

4. On the average, on how many nights of the week do you awaken spontaneously during the night? 0 1 2 3 4 5 6 7

5. Approximately how many times do you wake up during the night? Do not count your final awakening in the morning. ______________

6. When you do awaken during the night, how long does it usually take for you to return to sleep? Please estimate the length of time to return to sleep in minutes. ____________________

7. Have you ever awakened at night and found yourself choking or having trouble breathing? If so, how many times a week does this occur? ____________________

8. Do you consider yourself to be a:
   a) Very good sleeper
   b) Moderately good sleeper
   c) Very poor sleeper
   d) Moderately poor sleeper
   e) A chronic insomniac

9. How many hours of sleep do you usually get each night ______________;
   How many hours of sleep would you like to get each night ______________;

10. How easy is it for someone to wake you during the night?
    ______ Very easy    ______ Moderately easy
        ______ Moderately difficult    ______ Very difficult

11. Approximately what time do you go to bed at night? ____________________
    What time do you usually get up in the morning? ____________________

12. What is your marital status? Married  Single  Divorced  Widowed

13. What is your usual sleeping arrangement:
    a) Sleep alone
    b) Sleep with another person in one bed
    c) Sleep with another person in same room but separate beds
    d) Other, Explain ____________________
14. After going to bed, how much difficulty do you have in falling asleep
   ______ No difficulty ______ Quite a bit of difficulty
   ______ Very little difficulty ______ Usually have much difficulty

15. How rested do you usually feel when you wake up in the morning?
   ______ Very rested ______ Not very rested
   ______ Moderately rested ______ Essentially not rested at all

16. Approximately how many times a month do you wake up early in the
    morning and then are unable to get back to sleep ________?

17. Do you have diabetes? ________
    Do you have any kind of physical problems? Please describe.

18. Do you smoke cigarettes? ________
    If so, approximately how many do you smoke a day? ________

19. Are you taking any kind of medication at this time? ________
    If yes, what kind and how often do you take it? ________

On the next pages, please check one box for each question. Thank you for
your time and cooperation.
13. Do you fall asleep:
   a. On long car trips
   b. While reading a book
   c. While studying
   d. During a play, at the theater
   e. On plane or train trips
   f. While watching a movie
   g. During lectures and speeches
   h. At times of stress
   i. While watching TV
   j. After a particularly good meal

14. Do you sometimes feel that you have slept too long?

15. Do you sometimes feel that you have not slept long enough?

16. Do you walk in your sleep?

17. Do you talk in your sleep?

18. Do you find sleep satisfying?

19. Do you have difficulty falling asleep at night?

20. Are you a deep sleeper?

21. Do you wake up during the night?

22. Do you fall asleep readily?

23. Do you take catnaps during the day?
INSTRUCTIONS FOR PART II

The last question you answered read:

23. Do you take catnaps during the day?

Your answer to this question was:

Always  
Usually  
Sometimes  
Rarely  
Never  

We are interested in studying some of the reasons why some people nap, but others do not, and what are some of the characteristics which account for whether people nap. The next part of this questionnaire is divided into sections, Section II and Section III. You should complete only ONE of the two sections, depending on your answer to question 23 regarding napping.

(A) If you answered question 23 either Rarely or Never (indicating that you rarely or never take catnaps), you should turn to the next section—Section II on the next page, and complete it. Do Not complete Section III.

(B) If you answered question 23 either Always, Usually, or Sometimes, indicating that you catnap at least sometimes, you should turn to Section III and complete it. Do Not complete Section II.

In summary, on the basis of your answer to question 23 about how often you nap, determine whether you should complete Section II or Section III. Complete the appropriate section.
Section II

1. Listed below are several reasons why a person may rarely or never nap. Please check each reason on the five point scale: 5 indicating the reason quite definitely applies to you; 1 indicating the reason is largely irrelevant.

<table>
<thead>
<tr>
<th>Reason</th>
<th>Definitely Applies</th>
</tr>
</thead>
<tbody>
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<td>a. No time available</td>
<td>[ ] 5 4 3 2 1</td>
</tr>
<tr>
<td>b. Napping is an unpleasant experience</td>
<td></td>
</tr>
<tr>
<td>c. I do not have any need to nap</td>
<td></td>
</tr>
<tr>
<td>d. Napping interferes with my work (studying)</td>
<td></td>
</tr>
<tr>
<td>e. Napping interferes with my leisure entertainment</td>
<td></td>
</tr>
<tr>
<td>f. I would not be able to fall asleep</td>
<td></td>
</tr>
<tr>
<td>g. I would not feel any better after napping</td>
<td></td>
</tr>
<tr>
<td>h. I would not feel any less tired after napping</td>
<td></td>
</tr>
<tr>
<td>i. If I napped, I would not be able to sleep well at night</td>
<td></td>
</tr>
<tr>
<td>j. I already get enough sleep, so do not need to nap</td>
<td></td>
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<tr>
<td>k. Napping produces unpleasant physical aftereffects</td>
<td></td>
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<tr>
<td>l. Napping produces unpleasant mental aftereffects</td>
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<tr>
<td>m. Resting without falling asleep is more beneficial</td>
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<tr>
<td>n. Napping is a sign of laziness</td>
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<tr>
<td>o. Other reasons (specify)</td>
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</tr>
</tbody>
</table>

2. Which, in order of importance, of the above reasons, are your main reasons for not napping? 1 ____________ 2 ____________ 3 ____________

Which of the above reasons are least important? 1 ____________ 2 ____________ 3 ____________
Section II continued

3. Was there a period of time when you did take naps at least sometimes?
   Yes__________No__________When?__________________________________________

4. a. What time of the day do you usually feel most alert and awake?
   b. What time of the day do you usually feel most tired and sleepy?
   c. What time of the day do you feel you work most efficiently?
   d. What time of the 24 hour day would you most prefer to go to sleep?
Section III

1. How often do you take naps? □ per month or □ per week

2. When did you last nap? Day ____________ Time from:____ until:____

3. What time of the day do you prefer to nap?

4. What time of the day do you least like to nap?

5. What time of the day do you feel most tired and sleepy?

6. What time of the day do you feel most alert and awake?

7. What time of the day do you feel you work most efficiently?

8. How long would the ideal nap last for you?

9. What is the longest period of time you nap?

10. What is the shortest period of time you nap?

11. When napping, how long does it take to fall asleep?

12. When you do nap, how long does it typically last?

13. How long after you awaken in the morning does it take before you are ready to take a nap?

14. How long before you plan to go to bed for the night would be the minimum time you would plan not to take a nap?

15. Check which of the following alternatives you think you would prefer:

   1. A regular (8 hours or so) continuous night's sleep
   2. Several short naps throughout the 24 hour day when you felt tired.
Section III continued

16. Could you fall asleep and nap every day if you had the time?  
   | Definitely YES | Possibly YES | Possibly NO | Definitely NO |
17. Would you like to be able to nap regularly in the daytime?  
18. Do you find that naps are generally very satisfying?  
19. Do most of your naps occur "accidentally" or involuntarily (e.g., while reading, watching TV, etc)?  
20. Do you voluntarily like to nap when you have the time?  
21. Would you like to have the chance to nap more often than you do?  
22. Do you awaken from a nap feeling more weary and tired than when you fell asleep?  
23. Does napping improve your ability to work (at a task, study, etc.) when you awaken?  
24. Does napping improve your ability to concentrate after you awaken?  
25. Are you less likely to nap if you got a regular night's sleep the previous night?  
26. Is a nap more satisfying if you received less than a regular night's sleep the night before?  
27. Do you nap even when you do not feel very tired?  
28. Could you nap almost any time during daytime hours?
Appendix D
Activation-Deactivation Adjective Check List

Name:

Date: pre-test or post-test

Instructions: Each of the words below describes feelings or mood. Please rate each of the words with the number (1-4) that best describes your feelings at this moment. Work rapidly, but please mark all the words. Your first reaction is best. This should take only a minute or two.

1 = definitely do not feel
2 = cannot decide
3 = feel slightly
4 = definitely feel

____ carefree ______ at-rest ______ quick
____ serious ______ elated ______ nonchalant
____ peppy ______ drowsy ______ quiescent
____ pleased ______ witty ______ clutched-up
____ placid ______ anxious ______ wakeful
____ leisurely ______ roused ______ rebellious
____ sleepy ______ fearful ______ active
____ jittery ______ lively ______ blue
____ intense ______ still ______ defiant
____ grouchy ______ self-centered ______ tense
____ energetic ______ wide-awake
____ egotistical ______ skeptical
____ calm ______ activated
____ suspicious ______ sad
____ tired ______ full-of-pep
____ regretful ______ affectionate
____ stirred-up ______ quiet
____ warm-hearted ______ concentrating
____ vigorous ______ sluggish
____ engaged-in-thought ______ overjoyed
### Major Factors of the Activation-Deactivation Adjective Check List

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<th>Deactivation-Sleep</th>
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<td>full-of-pep</td>
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<td>sleepy</td>
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<tr>
<td>vigorous</td>
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<td>peppy</td>
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<td>activated</td>
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Appendix F
Consent Form

The Ohio State University

Patient or Volunteer

Consent to Special Treatment or Procedure

Date__________________ Time__________________

I consent to the performance upon ____________________________ (Myself or name of patient)
of the following treatment or procedure: ________________

under normal laboratory conditions__________________________

The experimental portion of the treatment or procedure is: ________________

This is done as part of an investigation entitled: ________________

This treatment or procedure is to be performed by, or under the direction of Dr.

Amy Bertelson__________________, who is authorized to use the services of others in

the performance of this treatment or procedure.

1. Purpose of the procedure or treatment: ________________

2. Possible appropriate alternative methods of treatment: ________________

3. Discomforts and risks reasonably to be expected: ________________

4. Benefits which may be expected: ________________

5. Likely results of the experimental treatment or procedure: ________________

The above items have been explained to me by ________________ and I understand them. I understand that any further inquiries I may make concerning the procedure described will be answered. Finally, I understand that I am free to withdraw my consent and discontinue participation in this project at any time after notifying the project director and without prejudicing my future care. No guarantee has been given to me as to the results of this treatment or procedure.

Witness: ___________________________________________ Signed_______________________

Witness: ___________________________________________ (Patient or person authorized
to consent for patient)
Appendix G
Subject Information Sheet

This study is an investigation of the relationship between naps or bedrest and performance and mood. Your participation in this experiment will require that you arrive promptly at Upham Hall, 473 W. 12th Avenue, Room N156 at 1:00 P.M. or 1:30 P.M. on _________________________ (date). This experiment will take approximately three hours of your time. You will be asked to perform some reaction time tasks and answer some questionnaires about your mood. Electrodes will be placed on your scalp, near your eyes, and on your chin. These electrodes are not painful and will not cause harm, although your hair may become slightly sticky around the electrode sites. You will be assigned to a laboratory bedroom and asked to either take a nap or lie in bed but stay awake.

Please try to sleep approximately 7-8 hours at home the night before the experiment. Also, please refrain from alcohol and drug consumption the night before the experiment. On the day of the experiment, please do not drink coffee, teas, colas, or other caffeine products, and do not take any catnaps. Otherwise, please maintain your normal food and fluid intake and physical activity.

For participating, you will receive three hours of experimental credit for Psychology 100.

When you report to Upham on your experimental day, please bring with you the completed MMPI and MMPI booklet and the completed Sleep Questionnaire.
Appendix H

Outline of Procedure

I. Subject Selection
   A. Administer sleep questionnaire and Cornell Medical Index
   B. Choose Ss on the basis of their responses to above items
   C. Explain study, including risks and time involvement
   D. Give Ss a "Subject Information Sheet" (see Appendix G)
   E. Give Ss MMPI and extended sleep questionnaire to complete and return on their experimental day

II. Experimental Day
   A. Ss report to Sleep Laboratory at 1:00 or 1:30; collect MMPI and sleep questionnaire; sign consent form
   B. Auditory reaction time test
   C. Cognitive task (addition)
   D. Visual reaction time task (Stroop Color-Word Test)
   E. AD ACL
   F. MAACL
   G. Attach electrodes (EEG, EOG, EMG)
   H. Nap or bedrest condition for one hour
   I. Remove electrodes
   J. Bathroom break
   K. Auditory reaction time test
   L. Cognitive test (addition)
   M. Visual reaction time task (Stroop)
   N. AD ACL
   O. MAACL
   P. Give Ss a phone number to call if they want results from this experiment or MMPI interpretation. Sign S's experiment card and credit them 3 hours for participating.