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PSYCHOPHYSIOLOGICAL RELATIONS DURING SLEEP:
The Role of Individual Differences

by

Howard M. Schachter

A thesis submitted to
the Faculty of Graduate Studies and Research
in partial fulfilment of
the requirements for the degree of
Doctor of Philosophy

Department of Psychology

Carleton University
Ottawa, Ontario

April 30, 1987

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acceptance of the thesis

Psychophysiological Relations During Sleep:

The Role of Individual Differences

submitted by

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in partial fulfilment of the requirements
for the degree of Doctor of Philosophy

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ABSTRACT

Psychophysiological dream research has concerned itself historically with the investigation of the possible covariation of physiology and phenomenology during sleep. Two studies were performed to assess this relationship. Specifically, it was asked whether subjects are aware of and can describe the nature of a REM/2 experiential state difference which co-occurs with the REM/2 sleep stage distinction. Moreover the present research investigated this question from an individual difference perspective. This included an idiographic research strategy designed to elucidate the possible role played by the Frequency of Home Dream Recall individual difference in moderating these psychophysiological relations.

Data obtained in Study #1 disconfirmed Antrobus and Antrobus's (1967) hypothesis that sensitivity to internal states constitutes the condition sufficient to promote frequent dream recallers' successful identification of a REM/2 state difference. Following a modification of the theoretical position a second study was undertaken. The results from Study #2 disconfirmed the central hypothesis that Low frequency recallers' dependence on Stage REM for the occurrence of dream experience would make them more likely than High frequency recallers to identify a REM/2 state difference. Together these findings served to challenge a number of assumptions commonly held in the

sleep/dream research community.

The finding in Study #2 that High and Low frequency home dream recallers were barely distinguishable on the basis of their laboratory rates of sleep experience recall was a highly unexpected one. A theoretical argument was then developed. It was proposed that an important difference between these two types of subject may be manifest at the level of a post-production mechanism or process responsible for the transfer of dream material to the waking state.

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Finally, to the two most important people in my life--
Rachel and Davida:

Words cannot capture exactly what I feel for you;
and, how much your love, faith, devotion, companionship and
laughter have sustained me. My love for both of you grows
and grows with each remembrance of what we've been through
together. For this reason it is to the two of you that I
dedicate this work. More importantly though, it is to the
two of you that I dedicate my life.

INTRODUCTION

The present research program is designed to investigate the possible covariation of phenomenology and physiology during sleep as well as the role played by an individual difference variable-- self-reported frequency of home dream recall-- in moderating these psychophysiological relations. The specific question asked is whether there is a subject-identified REM/2 experiential state difference which co-occurs with the electrophysiologically-defined, REM/2 sleep stage distinction. It is answered by adopting an individual difference, discrimination-verification research strategy (eg. Antrobus & Antrobus, 1967).

Within the paradigm of psychophysiological dream research (Foulkes, 1978, 1981) the typical research question has been asked as follows. Are there different phenomenological events (eg. experiential states) which co-occur with an equal number of different, electrophysiologically-defined events (eg. two sleep stages)? Accordingly, the 'on-the-spot' awakening method has typically been employed (Foulkes, 1985). It involves the awakening of a subject following the experimenter's identification of specific electrophysiological events. The subject then provides specific information presumed to reflect experience that was temporally contiguous with the pre-awakening, electrophysiological event.

In research involving electrophysiologically-defined sleep stages, these 'events' are defined by patterns of bioelectrical brain activity, eye movement activity and

STAGE 2

EEG

EEG

EOG

EMG

muscle tonus quality as exhibited by the electroencephalogram (EEG), electro-oculagram (EOG) and electromyogram (EMG), respectively (cf. Rechtschaffen & Kales, 1968). In fact the REM/2 'psychophysiology' or 'state distinction' question has been one of the most popular research concerns (cf. Arkin, Antrobus & Ellman, 1978), and likely because these two sleep stages can be identified reliably by experimenters (Kubicki, Hermann & Holler, 1985).

Stage 2 is defined by the emergence of two EEG events which occur periodically against a 'tonic' background of low voltage, mixed frequency EEG. The two 'phasic' or intermittent EEG events are: 1) brief bursts of fast-wave, low voltage sinusoidal (spindle-like) activity (12-14 Hz); and 2) high voltage, biphasic forms called K-complexes which are sharply rising and falling, high amplitude delta waves (.5- 4 Hz). These delta waves may comprise up to 20 percent of Stage 2 EEG. In addition, muscle tone is present while eye movements are typically absent (cf. Rechtschaffen & Kales, 1968). Stage REM is defined by: 1) relatively low voltage, mixed frequency EEG; 2) fast, binocularly symmetrical eye movements; and 3) a marked decrease in anti-gravity muscle tone. Consequently the two stages are most dissimilar on the basis of the phasic EEG events in Stage 2 as well as the phasic eye movements and muscle tone drop off in REM. At this time a brief outline for the dissertation follows.

STAGE REM

EEG

EEG

EOG

EMG

Chapter 1 examines the reasons for the present research program as well as the methodological and philosophical attitudes adopted in these investigations. Chapter 2 shows how the strategy described in Chapter 1 is incorporated in the study of the following question. Is there a subject-identified REM/2 state difference co-occurring with the REM/2 sleep stage distinction? This is an uncommon form of a popular psychophysiological dream research question since only Antrobus and Antrobus (1967) have investigated subjects' awareness and descriptions of a REM/2 state difference. In the present research the basic query is investigated by addressing a number of specific questions, with each of the latter designed to illuminate a slightly different facet of the former.

The results obtained in Study #1 then suggest a modification of the initial theoretical position. This change is accomplished by highlighting the importance of a construct termed 'sleep state organization'. The revised theoretical perspective is then used to develop and answer a second research question contained in Chapter 3. That is, how does the (self-reported) Frequency of Home Dream Recall 'aptitude' moderate subjects' identification of a REM/2 state difference co-occurring with the REM/2 sleep stage distinction? Once again a number of specific questions are used to illumine slightly different facets of this basic one. The discussion of Study #2 is followed by a general discussion of: 1) the results obtained from the two studies undertaken in the research program; 2) the implications of

these findings; and 3) what these findings suggest for future research. At this time the rationale for Study #1 is presented.

CHAPTER ONE

1.1. Rationale for Study #1

The motivation for the present research may be described as follows. By using a research strategy employed extremely infrequently in psychophysiological dream research, Antrobus and Antrobus (1967) have provided suggestive results pertaining to the REM/2 state distinction question. However it will be argued in Section 1.2. that certain methodological decisions and difficulties have made their study a less than totally appropriate assessment of this research question.

Their technique was designed to elicit and then preserve subjects' potentially unique, experiential data by employing: 1) the on-the-spot wakeup method; 2) a discrimination-verification paradigm with performance feedback; and 3) idiographic data assessments. Moreover they controlled for the Frequency of Home Dream Recall 'aptitude' variable which has since been shown to moderate psychophysiological relations (eg. Armitage, 1980; Moffitt, Hoffmann, Wells, Armitage, Pigeau & Shearer, 1982; Moffitt & Hoffmann, 1987, in press; Purcell, Mullington, Moffitt, Hoffmann & Pigeau, 1986).

Antrobus and Antrobus (1967) asked whether subjects could discriminate experiential states associated with sleep stages 2 and REM and then describe the criteria used to distinguish the states. All REM arousals were made contiguous with rapid eye movements. That is, upon

awakening subjects were asked to identify the type of sleep from which they had been awakened and then delineate those phenomenological criteria having guided the discrimination judgments. Subjects were then given performance feedback to condition performance.

However, in order to increase their subjects' chances for success in discriminating sleep states the experimenters selected 3 female nurses who, it was argued, should be more sensitive to dreaming cues because they were each currently recalling at least three dreams per week. Empirical evidence has confirmed the hypothesis that frequent recallers of dreams are more sensitive to their internal states than are infrequent recallers (Foulkes, Spear & Symonds, 1966; Hiew, 1976, cited in Domhoff, 1985; Schonbar, 1965; Wallach, 1963).

Antrobus and Antrobus (1967) performed idiographic assessments which revealed that the performance of two subjects achieved a statistically significant level of correct responding. Moreover, subject #1 maintained her performance accuracy with REM arousals associated with ocular quiescence and no feedback. Finally, the experimenters attributed the third subject's failure to discriminate states to two factors. This subject was described as being an 'extreme intellectualizer' who seemed 'relatively insensitive to the class of subjective cues' used by the other subjects. Second, while all subjects complained of fatigue due to the number of nights (11-16 nights) and the number of arousals per night (mean of 7),

this third subject was the most adversely affected by experimental awakenings. She expressed having experienced considerable sleep deprivation.

Antrobus and Antrobus also found that the two subjects who successfully identified a REM/2 state difference provided phenomenological descriptions which agreed with discrimination judgments in indexing the existence of a state difference. The agreement of data reflecting subjects' awareness of a difference and its nature thus increased the confidence in the conclusion that a state difference had been found for two subjects. As well, the phenomenological descriptions explicated the nature of this difference.

Each subject's description of a state difference was slightly different. However for the purposes of brevity, the combined differences are detailed here. REM experience was typically distinguishable from Stage 2 experience in that the former was more likely to involve: a higher incidence of having a recallable experience; a sounder, deeper, more relaxed sleep; clearer and more vivid visual experience ('dreams'); greater degrees of active participation as well as physical and emotional involvement in experience. On the other hand Stage 2 involved: a lighter sleep; the sense of having been awake prior to the wakeup call; and, shorter, more vague experiences or dreams comprised of single images, more thinking, and little affect.

These results overlap to some degree with those obtained using the traditional methods for collecting phenomenological data in psychophysiological dream research. These may be called the report-evaluation and question-probe strategies. The former technique involves requesting a report of a possible pre-awakening experience from an awakened subject and then having the experimenter independently rate the report for the presence and/or intensity of a characteristic (eg. Antrobus, Rich, Pass, Nelson & Sanders, 1973; Antrobus, Pass, Luck, Sanders, Ellman & Arkin, 1974). The latter (Ericsson & Simon, 1980, 1984) entails inducing subjects to respond to questions in the terms provided by a response scale (eg. Foulkes, 1962).

Using these methods researchers have found that sleep experiences associated with REM and Stage 2 are often so similar that experimenters cannot tell them apart (cf. Monroe, Rechtschaffen, Foulkes & Jensen, 1965). For instance, reports of vivid dreaming have been found in association with all sleep states (Foulkes, 1985). Hence the description of a REM/2 state difference is likely best expressed in probabilistic terms (cf. Antrobus, Fein, Jordan, Ellman & Arkin, 1978; Cohen, 1979; Foulkes, 1962, 1985; Hendricks & Cartwright, 1978; Pivik & Foulkes, 1968; Schwartz, Weinstein & Arkin, 1978; Vogel, Barrowclough & Giesler, 1972; Webb & Cartwright, 1978; Wolman, 1979; Zimmerman, 1970).

Relative to Stage 2, REM phenomenology has been found to be more likely characterized by a higher incidence or

intensity of the following qualities: having a recallable experience; dreamlike, perceptual quality; the dreamer's involvement in the sleep-world (eg. active participation, vs. passive observation, direct physical contact with characters or objects, expression of experienced feelings); overall length, complexity, clarity, elaboration (eg. number of human characters, scenes) and continuity of the sleep experience (eg. 'flow' vs. fragmented and cut-up); and, relaxed and sound as opposed to restless and agitated sleep. On the other hand, relative to REM, 'Stage 2' phenomenology has been found to involve more reports of: imageless thinking as the primary or sole activity; and, reports of being awake prior to experimental arousal.

However, what follows is a critical evaluation of Antrobus and Antrobus's study. One consequence of this appraisal will be a decreased confidence their results could be said to replicate the findings just described.

1.2. Critique

Despite the overlap of many of the findings obtained by Antrobus and Antrobus and those using report-evaluation and probe methodologies, there is little confidence in the internal validity and generalizability of the former's results. It is argued that certain decisions and difficulties made the Antrobus study a problematic test of their own hypothesis as well as noncomparable with the research just reported.

First, subjects were nurses working the night shift

and thus their daytime sleep make inappropriate any comparison with the report-evaluation and probe research. The basic reason is that studies using the latter two techniques have evaluated night sleep. This is an important difference since night and day sleep demonstrate different architectures and yield differences in subjects' reported qualities of sleep (cf. Kubicki, et al, 1985). The distribution of sleep cycles across the day sleep period is reversed to a large extent from night sleep. For example, REM sleep predominates the early and later portions of day and night sleep, respectively. Moreover, the differences in sleep quality between day and night sleep are heightened for subjects changing shifts often. That is, the deleterious effects of shallower sleep, less total sleep time and a higher incidence of spontaneous arousals associated with day sleep are magnified by multiple shift changes (cf. Walsh, Tepas & Moss, 1981). Antrobus and Antrobus recognized this problem in their study and they suggested that "regular night sleepers, with more stable sleep patterns" should be studied (p. 55).

Second, with awakenings performed randomly the authors likely produced a distribution of wakeups biased toward having one type of awakening performed exclusively during the early or late parts of the night (Herman, et al, 1978; Schwartz, et al, 1978). This would constitute an important threat to internal validity since experiential differences defining REM/2 state differences also characterize the

discriminability of states occurring early versus later in the night (Schwartz et al, 1978).

The nature of this time of night effect is described as follows. For both REM and Stage 2 these characteristics increase in incidence or intensity progressively across the night: recallable experience and signal-verified lucid dreaming; dreamer involvement (eg. emotional expression); vividness, color and clarity; and, length, detail and complexity of the experience (Arkin & Antrobus, 1970; Armitage, 1980; Barber, Walker & Hahn, 1973; Cartwright, 1975; Domhoff & Kamiya, 1964; Foulkes, 1966; Hauri & van de Castle, 1973; Laberge, 1985; Pivik & Foulkes, 1968; Ramsey, 1953; Rechtschaffen & Buchignani, 1983; Reinsel, Antrobus & Wollman, 1983; Verdone, 1965). Moreover the greatest difference has been reported for experiences associated with the first and all other REM/NREM cycles (cf. Pivik & Foulkes, 1968).

Third, the poor empirical control of the time permitted to elapse into a sleep stage before an experimental arousal is performed can also constitute a threat to internal validity. This methodological issue is an important one since the probability of dream recall and the degree of dream emotionality can each increase as a monotonic function of time into stage (eg. Czaya, Kramer & Roth, 1973; Kramer, Czaya, Arand & Roth, 1974). Antrobus and Antrobus failed to control for this confound.

Fourth, it is unlikely considering their published description that Antrobus and Antrobus adjusted their

binomial tests to account for the unequal distribution of wakeups from the two sleep stages (REM > Stage 2). This may have produced a biased statistical representation of subjects' performance. Fifth, very few subjects were studied and this limits possible generalization. Sixth, the fact that Antrobus and Antrobus controlled for frequency of recall may make their results noncomparable with findings produced by report-evaluation and probe research since the latter ignored this individual difference (eg. Foulkes, 1962).

Overall then there are enough difficulties characterizing the Antrobus and Antrobus study to limit the internal validity and generalizability of their study and findings. Therefore it is unlikely that Antrobus and Antrobus's findings could be conceived as meaningfully replicating report-evaluation and probe findings. Unfortunately there is no way to determine what the Antrobus results are artifactual of since numerous confounds could have been operating. Consequently it is this author's view that the hypothesis that sensitivity to internal states is a sufficient condition for subjects to identify a state difference was not tested in an appropriate fashion. Therefore it was decided to test this hypothesis by using nighttime sleepers and by extending Antrobus and Antrobus's research strategy.

In preparation of this endeavour a number of issues are discussed in the next section. First, the advantages of

Antrobus and Antrobus's basic methods for answering psychophysiological research questions are described. Second, support for the suggestive nature of this strategy will be elucidated by pointing out the importance of the results obtained by other research having used similar methods to study subjects' awareness of psychophysiological relations.

1.3. Advantages of the Method

If one goal of psychophysiological dream research is to evaluate subjects' awareness of a REM/2 state difference, then Antrobus and Antrobus's discrimination-verification strategy is likely an extremely appropriate one. The following discussion will reflect an analysis of the major components comprising Antrobus and Antrobus's strategy. Where relevant, additional research will be highlighted to reinforce the value of these components. For instance, by employing the on-the-spot method, subjects are kept as close to their own sleep experience and this likely ensures the most accurate description possible (Foulkes, 1981, 1985). In addition, research evidence has suggested the value of discrimination tasks in research aimed at investigating the possible discriminability of phenomenological events.

To be exact, subjects need not be able to articulate an awareness of the experiential basis for the difference between events to be able to discriminate them successfully (cf. Adams-Webber & Mancuso, 1983; Ericsson & Simon, 1980,

1984; Fransella & Bannister, 1977; Kelly, 1955; Mancuso & Adams-Webber, 1982; Nisbett & Wilson, 1977; Rosch & Lloyd, 1978; Smith & Medin, 1981).⁴ Consequently an awareness of a state difference in psychophysiological dream research ('what type of sleep were you awakened from?') might be easier to articulate than is an awareness of the nature of the difference ('on what basis are the two types of sleep different?').

On the other hand, it has been argued by Brown and Cartwright (1978) that Antrobus and Antrobus's categorical discrimination task is a more difficult one than the one used by Monroe, Rechtschaffen, Foulkes, and Jensen (1965). Monroe had judges evaluate REM and NREM experience reports simultaneously to see which in each pair was the most REM-like. Antrobus and Antrobus's subjects had to perform as on a concept formation task. That is, on each trial the subject develops or modifies a boundary criterion used to judge subsequent experiential events as belonging to one category or the other. Thus each judgment that one experiential state is present refers to the subject's recognition of some value of a critical feature which differentiates the states (Sewitch, 1984). And, in this way the successful identification of a state difference over a number of trials amounts to the delineation of a state 'concept' (Antrobus, et al, 1965; Brown & Cartwright, 1978; Gibson, et al, 1982).

On the other hand, the advantage of also asking subjects to articulate the phenomenological criteria

associated with discrimination judgments can be described as follows. Data reflecting subjects' awareness of the nature of a possible state difference can be used to see if they: 1) corroborate discrimination information regarding the existence of a state difference; and 2) explicate the experiential nature of the difference. Then, if phenomenological descriptions and discrimination judgments were to agree on the existence of a state difference, the former would likely constitute the nature of the distinction.

Consequently this type of research strategy could be considered a converging operations one. Using different perspectives on experiential states, slightly different answers to the REM/2 psychophysiology question might be obtained. Thus, rather than assume that any single operation will index the REM/2 state difference perfectly, a strategy with a good payoff might be to build the most complete and reliable answer to this question by assessing the convergence of multimethod data (cf. Campbell, 1986; Campbell & Fiske, 1959; Feigl, 1958; Garner, Hake & Eriksen, 1956; Gibson, et al, 1982; Howard, 1982; Stoyva & Kamiya, 1968). In this way this method can increase the confidence in selecting the most probable hypothesis as well as compensate for idiosyncratic observation (cf. Barber, 1976; Brandt, 1982; Howard, 1982; Stoyva & Kamiya, 1968). Other research has employed this technique as well.

One variation on this method has been to request that

subjects make microswitch signals while asleep or upon awakening to indicate their awareness of a particular experiential event and then have subjects verify or corroborate this signal with an experience report. For instance, in studies designed to see if dreaming is associated exclusively with REM, subjects were taught to make one microswitch signal to designate the presence of dreaming and another to signify its absence (cf. Antrobus, et al, 1965; Brown & Cartwright, 1978). Results indicated that dreaming signals occurred throughout sleep albeit more often during REM. Moreover Brown and Cartwright found that signals indicating dreaming were more reliable predictors of its presence than were the sleep stage criteria having guided experimenter-initiated arousals.

Gibson et al (1982) extended Redington et al's (1981) research by employing a request for verification of signals in the study of sleep onset stages. Upon awakening from stages alpha-EEG, 1 and 2 Gibson's subjects were asked to signal judgments by making 1, 2 or 3 button presses guided by "any subjective criteria.. to indicate their level of wakefulness or asleepness on a descending scale from 1 to 3" (Gibson, et al, 1982, p. 1027). Subjects then provided phenomenological criteria and responses to probes, the latter reflecting data on sleep onset differences obtained using report-evaluation and probe techniques (Foulkes & Vogel, 1965; Vogel, et al, 1966). Half the subjects received feedback and on the third night only.

Nomothetic and idiographic evaluations revealed that

subjects' discriminations reliably identified a stage W/1 but not a stage 1/2 distinction. Moreover subjects' phenomenological descriptions tended to corroborate discrimination performance, increasing the reliability of this result. A stage 1/2 difference was not identified using either method, and for some subjects idiographic analyses revealed that the stage W/1 difference was absent altogether. Overall, subjects tended to signal sleep stages lighter than the one they had been in. Moreover the absence of a perfect state-stage correspondence corroborated Vogel et al's (1966) demonstration of the absence of an exact, tripartite Ego state-sleep stage parallel. Finally, the nature of the W/1 state difference was defined in terms of three criteria (eg. awareness of surrounds).

Campbell and Webb (1981) also employed a signal-verification procedure and they succeeded in confirming the finding that reports of being awake during the sleep state were associated significantly more often with Stage 2 than REM trials (cf. Antrobus & Antrobus, 1967; Antrobus & Saul, 1980; Coates, et al, 1983; Goodenough, et al, 1965; Kamiya, 1961; Sewitch, 1984; Zimmerman, 1970). Moreover it was found that many signals occurred independent of EEG-awake intervals, and presence/absence of dreaming during the pre-arousal period was an unreliable discriminator of asleep/awake judgments. Many reports of being asleep occurred in the absence of dreaming reports while some awake decisions were associated with reports of dreaming.

Laberge (1985) taught experienced lucid dreamers to signal the occurrence of lucid dreaming by making an intentional sequence of eye movements with their 'dream eyes'. The sequence constituted a signal which could then be recognized by an experimenter observing the on-line EOG tracings. Laberge's 'proof' of the existence of lucid dreaming was then provided when dreamers were awakened following a signal. They invariably reported both the experience of lucidity and having executed the sequence of eye movements while asleep and dreaming. The result that signals are reliable guides to lucid dreaming experience has been replicated on numerous occasions and in many laboratories (Moffitt & Hoffmann, 1987, in press).

There are additional techniques which Antrobus and Antrobus employed, and which proved valuable. They recognized the need to select specific subject groups varying in terms of some aptitude with reference to sleep experience. They recruited subjects on the basis of the Frequency of Home Dream Recall aptitude. This was an important decision in light of the recent body of research evidence demonstrating how this individual difference variable can moderate psychophysiological relations during sleep (eg. Armitage, 1980; Moffitt, et al, 1982; Moffitt & Hoffmann, 1987, in press; Purcell, et al, 1986). For example, in research systematically varying this variable, 'High frequency recaller' has referred to a subject recalling at least 5 dreams per week; and, 'Low frequency recaller' has been defined as a subject recalling 2-4

dreams per month, or less.

Using report-evaluation and probe methods, High recaller males' overall, laboratory recall incidence from Stages REM, 2 and 3/4 was found to exceed that of Low recallers (cf. Armitage, 1980; Moffitt, et al, 1982). The greatest difference between High and Low recallers held for Stage 3/4 recall incidence, the smallest being for REM, and with the Stage 2 difference intermediate to these other two. In all cases High recallers' rate exceeded that of Low recallers.

Looking only at recalled experience and relative to Low recallers, High recallers' experience exhibited a greater degree of each of the following qualities: dreamer involvement (eg. active participation, emotional expression); elaboration (eg. number of people, scenes), vividness and clarity; color; implausibility; and, self-reflectiveness (cf. Armitage, 1980; Moffitt, et al, 1982; Purcell, et al, 1986). However, these differences did not occur in uniform fashion across all three sleep stages.

These findings point out the importance of controlling for or manipulating this individual difference variable in psychophysiological dream research (Herman, et al, 1978). For instance, if a study were to include an heterogeneous group of ^{low} recallers and without some form of statistical control, then differences in psychophysiological relations associated with these different types of subject might become obscured when data are subjected to nomothetic

analysis. This raises the issue of the final advantage illuminated by the research having used a strategy congruent with that of Antrobus and Antrobus (1967).

In order for many of these results to have constituted findings demonstrating the value of the discrimination-verification strategy, subjects' potentially unique experiential data were evaluated in idiographic fashion (eg. Antrobus & Antrobus, 1967). While repeated measures analyses control for subjects' potentially idiosyncratic variation by extracting it from error variance (eg. Antrobus, et al, 1978), idiographic assessments highlight the nature of individual subjects' unique psychophysiological relations. Consequently, had Antrobus and Antrobus collapsed discrimination data across subjects, the success of two of their subjects might have masked the failure by the third volunteer. Extreme or outlier data can sway group data. Moreover, since the exactness or nature of subjects' psychophysiological relations can vary when permitted to, then nomothetic assessments could obscure these individual differences (eg. Antrobus & Antrobus, 1967).

Therefore the value of a discrimination-verification technique can be enhanced by including both nomothetic and idiographic data treatment procedures. The reason is that the former can convey an overall picture of the results. The latter can preserve the possible uniqueness of individual subjects' data in the study of the role played by the Frequency of Recall aptitude in moderating

psychophysiological relations. At this time a summary is required.

The value of the method used by Antrobus and Antrobus (1967) is reinforced by the importance of findings obtained by researchers having used the same procedure. First, psychophysiological relations can vary across Frequency of Recall subject groups as well as individual subjects. These relations refer to the fit between subject-identified, experiential states and polygraphically-defined, physiological categories such as 'asleep' and 'awake', or 'REM' and 'Stage 2'. Second, Laberge's (1985) results have shown the possibility exists that there are certain subjects whose psychophysiological covariation data can be used to successfully inform isomorphist, parallelist or reductionist views of experience-physiology relations (Moffitt & Hoffmann, 1987, in press).

Third, data reflecting the absence of exact psychophysiological parallels suggests the limited usefulness of some conventional categories of physiology as guides to or explanations for certain types of human experience. For instance " ..'being awake' and 'being asleep' are not univocal expressions nor are they mutually exclusive" (Moffitt & Hoffmann, 1987, p. 149). Therefore this strategy has generated data disconfirming at least one widely held assumption-- that experience associated with different "kinds of sleep.. must differ because the neurophysiological organization of each is so different"

(Zimmerman, 1970, p. 548). On the other hand, whether this assumption can in fact hold for certain subjects yet not others may best be determined by employing a strategy like the one used by Antrobus and Antrobus.

Therefore, in light of these results it is becoming increasingly clear that one of the major contributions made by an individual difference, discrimination-verification approach is the following. It is an appropriate vehicle for accomplishing a recently articulated goal for dream psychophysiology. Where phenomenology and physiology are the 'fields of knowledge' in question, the categories or distinctions within each of these fields can be clarified when juxtaposed with one another. That is, the goal may be defined as follows:

Ordering of observed facts in one field of knowledge [can be used to] challenge a hypothetically parallel order of facts in another field of knowledge: correspondences and discrepancies might be seen, and the identification of such inconsistencies between two corresponding sets of orders might lead to the clarification and correction of the orders and thus, lead to new syntheses and new hypothesis building.. Psychophysiology aims at such intermethod comparisons. (Lehmann & Koukkou, 1984, p. 51)

For instance subjects' phenomenological data might suggest physiological distinctions or measures which could be more closely related to the former than are Rechtschaffen and Kales's (1968) sleep stage distinctions (Antrobus & Saul, 1980; Redington, et al, 1981). Moreover in light of the research evidence described above the goal of juxtaposing the two fields of knowledge should probably take into account individual differences in promoting a better understanding of some absolutely fundamental

categories of the ordinary language of science and of everyday life,' specifically 'being awake', 'being asleep', 'waking up', 'having a dream', 'being conscious and asleep' [cf. Kleitman, 1955], and so on. Modern dream psychophysiology can help to shed significant new light on our understanding of some of these archaic categories of experience in the context of the development of what Humphrey [1983] has called a 'natural' psychology. (Moffitt & Hoffmann, 1987, in press, p. 166)

It is with this attitude that Study #1 is undertaken. The purpose of this study is to test Antrobus and Antrobus's (1967) hypothesis and by using nighttime sleepers as well as a strategy extending the one employed by those researchers. Attention is now turned to this research.

CHAPTER TWO.

2.1. The Research Questions

The present study investigates the first REM/2 psychophysiology question proposed in Chapter 1 by testing Antrobus and Antrobus's (1967) 'sensitivity' hypothesis. The question asked is whether there is a subject-identified REM/2 state difference co-occurring with the REM/2 sleep stage distinction. The Methods include: 1) an assessment of night sleep; 2) the on-the spot technique to keep subjects as close to their sleep experience as possible; 3) a discrimination-verification method designed to elicit phenomenological descriptions potentially corroborating and explicating discrimination judgments; 4) nomothetic and idiographic data treatments, the latter designed to permit the evaluation of whether psychophysiological relations vary across subjects; 5) the empirical control of possible Frequency of Recall, time of night and time-into-stage confounds; and 6) the inclusion of fewer nights than Antrobus and Antrobus used and to preclude fatigue.

Antrobus and Antrobus suggested that High frequency recallers of dreams would be more likely to identify a REM/2 state difference since they are more sensitive to their internal states than are Low recallers (eg. Foulkes, et al, 1966; Schonbar, 1965; Wallach, 1963). However, in light of the fact that exact state-stage correspondences have rarely been found (Section 1.3.) it was decided to train subjects to enhance their chances for identifying a REM/2 state difference. Moreover it was felt that the

greater sensitivity to internal states demonstrated by High recallers would more likely enhance the effects of Training than would the lesser sensitivity shown by Low recallers.

Training involves two practices. Using descriptions of qualities having previously defined REM/2 state discriminability, subjects' attentional bases for perceiving and vocabulary for describing sleep phenomenology are educated (cf. Michaels & Carello, 1981). Second, performance feedback is provided to help subjects develop the best discrimination strategy possible (cf. Antrobus & Antrobus, 1967; Gibson, et al, 1982; Kamiya, 1969; Sewitch, 1984; Stoyva & Kamiya, 1968). Then it is expected that with sufficient trials a High recaller should become a reliable, sensitive perceiver and reporter of the two sleep events under investigation. However, High recallers have demonstrated an additional aptitude that might increase their chances for identifying a REM/2 state difference.

Herman et al (1978) have asserted that the 'analytic abilities' of a subject would likely facilitate discriminations of sleep phenomenology. High recallers demonstrate such a quality. That is, Frequency of Recall has been found to covary in significant fashion with a field-independent cognitive style (cf. Eagle, 1974; Goodenough, 1976; Goodenough, et al, 1959, 1974; Linton, 1974; Schonbar, 1965; Witkin, et al, 1974, 1979; Witkin & Goodenough, 1981). That is, relative to Low recallers, High

recallers have been found to perform more successfully on tasks requiring the segregation of perceptual figure-ground and on discrimination or concept formation tasks such as the one employed in the present research (Goodenough, 1976; Goldstein & Blackman, 1978). The reason is that they are less likely to rely rigidly on the nonself 'field' to guide dis-embedding performance. Rather, they are more apt to perform flexibly on discrimination tasks, and especially when it comes to modifying their strategies in response to performance feedback (Goldstein & Blackman, 1978; Witkin & Goodenough, 1981). Consequently it might be expected that relatively field-independent, High recallers could translate this aptitude into a successful strategy designed to identify sleep states.

However, one possible objection could possibly be directed at the plan to train subjects in the present research. In light of the literature on the effects of demands on reports of dream phenomenology (eg. Barber, et al, 1973; Belicki & Bowers, 1982) the possibility arises that Training will constitute bias ensuring subjects' identification of a state difference in the terms used to educate their attention. This is a reasonable concern since Gibson et al (1982) found the following. They recognized that by asking subjects question-probes which captured earlier research findings (Foulkes & Vogel, 1965; Vogel, et al, 1966), they had inadvertently communicated demands to subjects regarding the importance of these variables for the discrimination task at hand. Then, without being

instructed to, subjects used these constructs to discriminate and articulate the bases for a sleep onset difference.

However Gibson et al's results also revealed that making demands available did not ensure subjects' demonstration of a tripartite distinction as might have been predicted on the basis of dream research on demand characteristics or report-evaluation and question-probe investigations of psychophysiological relations at sleep onset (eg. Foulkes & Vogel, 1965). One way to interpret this result is that successful discrimination involves more than just noticing that sleep experience is characterizable in these terms. That is, subjects are required to notice that different values of the qualities can be associated reliably with the different sleep states. This presupposes a difference between the states.

Therefore it was decided to employ a pre/post design and evaluate the effects of Training on subjects' ability to identify and describe a state distinction. It was assumed that if a state difference were absent (eg. Gibson, et al, 1982) then biasing would be unlikely to produce evidence for its existence. Furthermore, to optimize subjects' chances further a more extreme group of recallers than in Antrobus and Antrobus's study is included. These are described in Section 2.2.2.

In addition it was hoped that by explicating all demands subjects would feel less obliged to use Training

information exclusively, if at all. Subjects are told that since Training information was obtained using methods which did not rely heavily on subjects' unique discriminations of sleep states, then this knowledge might be no more useful than their own criteria in guiding identifications of sleep state. Furthermore, subjects are encouraged to use whatever works for each of them and that Training serves only as a guide to the possible nature of the differences. The practice of explicating demands follows from the view that the best way to preclude expectations from operating as self-fulfilling prophecies is to make public all assumptions (cf. Brandt, 1982; Watzlawick, 1984).

The following are thus the specific research questions investigated in Study #1 and they pertain to Post-test nights:

1. Are subjects aware of the existence of a REM/2 state difference which co-occurs with the REM/2 sleep stage distinction? That is, can subjects successfully discriminate target stages of awakening?
2. Are subjects aware of the nature (ie. phenomenological criteria) of a REM/2 experiential state difference? That is, are there different patterns of phenomenological criteria associated with the two sleep states?
3. Does subjects' awareness of the nature of a state distinction corroborate their awareness of the existence of a REM/2 state difference? That is, do patterns of phenomenological criteria corroborate subjects' discriminations of target stages in indexing the existence of a REM/2 state difference?

Thus, if subjects' awareness of a state difference corroborate their awareness of a difference evidenced by statistically significant discrimination performance, then the former likely constitutes the information having guided

successful identifications of the distinction.

There are two basic ways in which a REM/2 state difference can be defined: the incidence of recallable experience; and, experiential differences between the states. Therefore it was decided to ask these additional questions.

4. When subjects' phenomenological descriptions are examined, is there a difference in the incidence of recallable experience which distinguishes the two sleep states?

5.a. Does having recallable experience available to awakened subjects affect their awareness of the existence of a state difference?

b. Does having recallable experience affect subjects' awareness of the nature of a state difference?

A number of exploratory questions are planned as well. Will Training night results corroborate or explicate Post-test night findings regarding: 1) subjects' awareness of a state difference; 2) subjects' awareness of the nature of the difference; 3) the corroboration of the former by the latter; 4) recall incidence differences; and 5) whether having had a recallable experience affects: a) subjects' awareness of the existence; and b) the nature of a state difference?

Furthermore it has been argued elsewhere (eg. Nisbett & Wilson, 1977) that by missing certain information, subjects may fail to make discriminations of experiential events. Therefore a question arises. Are subjects aware of all of the possible bases for a state difference or is there information which, if noticed, could have guided the successful identification of sleep states? In the present

research question-probes are included on Training nights as reminders of relevant experiential dimensions by which experiential states might be discriminated. Therefore, since subjects may be unaware of how their responses to probes can demonstrate a REM/2 state difference when analyzed statistically, then the present study assesses subjects' responses to probes. The possibility exists that there are probe-defined state differences of which the subject was unaware; and, had the subject paid attention to this information then it could have been used to inform correct discriminations of sleep state. Consequently it is asked whether there are such bases of which subjects might be unaware and which successfully identify the existence and nature of a state difference. Finally, does having had a recallable experience affect the demonstration of the existence and nature of a state distinction of which subjects might be unaware?

Consequently, the following hypothesis is tested with reference to Post-test night information:

1. High recallers' sensitivity to internal states and cognitive style together should constitute the conditions sufficient to enhance the effects of Training in promoting subjects' successful identification of a REM/2 experiential state difference.

2.2. Method

2.2.1. Design

A modified pre/post-test design was adopted to permit the assessment of the possible interactive effects of Training in enhancing High recallers' identification of

sleep states. Ss spent a single pre-test night in the laboratory serving as a practice and acclimatization session. It was assumed that having subjects matched in terms of Frequency of Home Dream Recall and other attributes assumed to covary with Frequency of Recall (ie. sensitivity to internal states; recall ability; field independent cognitive style) would loosen the need to include a formal set of pre-test nights (cf. Campbell & Stanley, 1963). This accounts for the modification in design and the decision not to perform analyses of Pre-test data. Moreover three training and two post-test nights were planned. The six sleep sessions were scheduled across consecutive nights to promote massed practice.

2.2.2. Subjects (Ss)

The Ss selected were five volunteer male students (ages 19-24 years) identified as self-reported, High frequency home dream recallers. Each was currently recalling one dream per night, and with rare exception. Three of the Ss were Introductory Psychology students contacted in class and each required Participation Credits to pass their course (Appendix A1). Males were selected to permit contrast with similar dream psychophysiology research using the Frequency of Recall variable (eg. Poulkes, 1962; Moffitt, et al, 1982) and because the E was male. The exclusive assessment of males circumvented the need to have a female E present when female Ss sleep in the laboratory. All Ss were functionally and familially right-

handed since the EEG of right- and left-handers can differ (cf. Wang, 1980) and since other research has also employed this criterion (eg. Moffitt, et al, 1982).

A familiarity with the extant literature (eg. Schwartz, et al, 1978) suggested that Ss should sleep at least 7 to 8 hours per night in order to sustain the number of planned arousals per sleep session. Ss were asked that while involved in the study to abstain from alcohol or drug consumption as well as atypical napping to preclude the alteration of their normal sleep patterns (cf. Cohen, 1979). Finally, Ss were matched in terms of pre-test and training night wakeup schedules and procedures as well as materials used throughout the study. Post-test night schedules of awakening were developed to control for the possible effect of schedule on the results.

2.2.3. Apparatus

The equipment facilitating identification of sleep stages included: Grass EEG preamplifiers with 60 Hz filters; dual beam Tektronix oscilloscope; Sony audio reel-to-reel tape recorder; LSI-1173 computer with electrophysiological signal display program; color video adapter; and, color video monitor. Electrophysiological data were not stored since this was pilot research. On-line display of electrophysiological signals permitted sleep stage identification using Rechtschaffen and Kales' (1968) conventions. Ss slept in a 10' x 6' x 8' air-conditioned, anechoic chamber equipped with an intercom. All verbal

exchanges were audiotaped.

2.2.4. Procedure

A phone call followed up the initial contact and basic information was provided for prospective Ss (Appendix A2). Ss meeting the criteria were scheduled to sleep 6 nights in the laboratory. On the first night each S was given a complete tour of the facilities and sleep chamber in the hope that familiarity with the lab and the E would make Ss comfortable and thereby preclude the first night effect found in some laboratory dream research: eg. fragmented sleep (cf. Agnew, et al, 1966; Browman & Cartwright, 1980; Webb & Campbell, 1979). Then, prior to the hook-up on the pre-test night Ss were briefed by reading a description of what was expected of them during the night (Appendix A3). The Ss were permitted to request clarification of instructions.

The hook-up procedure and electrode montage were the same for all nights. Continuous, standard monopolar, polygraph recordings were made at EEG sites C3-C4 (centrals), with linked ear references. Bipolar EOG (E1-E2) and two submental EMG sites were recorded from as well. Beckman miniature Ag/AgCl EEG electrodes were attached externally using: Grass EC-2 electrode paste, and electrode patches. EOG, EMG, reference (two ears) and ground (forehead) electrodes were affixed using adhesive collars, Synapse conductive electrode cream, and electrode patches.

Following the hook-up on each night the Ss were put to

bed and the lights turned off. Experimental awakenings followed a specific schedule (Appendix A12), with each planned arousal being the 'first' or 'next' occurrence of the designated target stage. Each wakeup was initiated by a firm voice call of the S's name in the hope that it would provoke a relatively quick awakening. Gradual or slow awakenings are considered problematic and hence to be avoided on the grounds that Ss have been found to fall back asleep and forget pre-arousal experience under these conditions (cf. Goodenough, 1978). All Ss' wakeup schedules were the same across the first four nights to standardize their training experience. More detail on awakenings is provided in Section 2.2.5.

Upon awakening Ss were asked to remain still and with eyes closed. This practice was designed to facilitate Ss' reflection on pre-arousal experience. Lerner (1967) as well as Cohen and Wolfe (1973) have echoed Rorschach's (1942) concern that excessive body movements upon arousal can interfere with the recall of dreaming experience. The reason is that kinaesthetically experienced body movements in dreaming can be blotted out or lost upon awakening by excessive movement. In the same vein Cohen (1974) has cautioned that the more an awakened S's attention becomes focussed on the external environment upon arousal, the more likely this diversion will lead to forgetting. Finally, the wakeup protocol on the Pre-test night was employed (Appendix A4). Ss were unhooked in the morning following

arousal at a time designated the night before.

On each of the Training nights the Ss arrived one half hour earlier than on the Pre-test night to have their attention educated by reading and discussing a condensed summary of the literature on REM/2 sleep state discriminability (Appendix A5). As stated in Section 2.1., a major emphasis was placed on Ss becoming acquainted with this information while understanding that these variables might be less useful than their own for the discrimination task. Then, following the hook-up the S went to bed and the wakeup protocol was employed after each arousal (Appendix A6). Question-probes serving as reminders of relevant experiential dimensions were also directed at Ss (Appendix A7). Performance feedback constituted the final facet of training. Upon awakening in the morning Ss were unhooked and then asked a few Inquiry questions designed to clarify Training night information (Appendix A8).

The wakeup protocol on Post-test nights was the one used on the Pre-test night (Appendices A3 and A4). In addition, the Embedded Figures Test of Field-independence was administered prior to the hook-up on the second Post-test night (Appendix A9). Following awakening in the morning of the last sleep session an Inquiry from Training nights (Appendix A8) was augmented by additional questions to further clarify information in the study (Appendix A10). In addition, a 'Differentiation Task' was performed by Ss as part of the final Inquiry (Appendix A11). Finally Ss were briefed as to the purpose of the study.

2.2.5. Conventions Defining Experimental Awakenings

Eight wakeups were scheduled per night, per S, with four from each type of sleep. Two REM and two Stage 2 awakenings were planned for each half of the night to control for a possible time of night confounding of between-stage differences (eg. Pivik & Foulkes, 1968: Appendix A12).

Stage REM with at least one rapid eye movement burst every 2 minutes and Stage 2 were selected as the target stages to maximize REM/2 discriminability electrophysiologically (cf. Rechtschaffen & Kales, 1968; Kubicki, et al, 1985). A standard time into stage criterion (eg. Zimmerman, 1970) was used to control for a possible time-into-stage confound.

A minimum of 5 minutes and a maximum of 8 minutes were required to signal an experimental awakening. While a minimum of 12 minutes was selected as the between-wakeup interval, the fact that Ss can often return to Stage 2 quickly following a prior arousal necessitated flexibility in the application of this criterion. A number of additional conventions were designed to deal with unexpected situations (Appendix A13).

2.2.6. Operations

On all nights discrimination judgments were solicited to evidence Ss' awareness of the existence of a state difference. Certainty ratings were included to promote Ss' reflection on data used to inform identifications of sleep

'state. The Ss' phenomenological descriptions of discriminative cues were elicited to index Ss' awareness of the features possibly defining a state difference and which may have informed discrimination judgments.

On Training nights question-probes were included as possible indices of bases by which the states were discriminable yet of which the Ss may not have been aware. Responses to probes were <scaled (Appendix A7) to dimensionalize the figural nature of the particular characteristic being assessed. That is, alternatives typically ranged between 'absence of a characteristic' (score of '1') and 'clear or strong (ie. figural) presence of this characteristic' (score of '7'). Therefore the absence of all characteristics indicates the absence of a recallable experience in the same sense that "Nondreaming is nothing-- there are no landmarks-- nothing to notice" (Antrobus, et al, 1965, p. 400). As a result probes could be used on all trials since the presence of a pre-awakening experience was not required. Form A of the Embedded Figures Test was employed.

2.3. Results

2.3.1. Data Treatment Conventions

Nomothetic and idiographic assessments of the data were performed. Moreover, the idiographic nature of data analyses used to identify the nature of individual Ss' potentially unique phenomenological information necessitated performing a large number of statistical

tests. Consequently an alpha level of .01 was adopted to guard against Type I error.

Discrimination judgment data were analyzed using binomial tests applied to confusability matrices organizing correct and incorrect identifications of sleep stage (eg. Antrobus & Antrobus, 1967; Gibson, et al, 1982; Redington, et al, 1981; cf. Sewitch, 1984; Swets, 1986a, 1986b). The chi square statistic tested association of judgments and target stages while the kappa statistic indicated the reliability of the agreement of decisions and types of sleep from which Ss were awakened. Kappa was used as a measure of the accuracy of judgments. A value of '0' indicates chance agreement while '+1' reflects perfect agreement (cf. Fleiss, 1981).

While Signal Detection Theory's statistics are considered by some to be the most appropriate indices of discrimination accuracy (cf. Swets, 1986a, 1986b), the number of observations that would be required to justify the use of even nonparametric versions (>50 per target stage) far exceeds what was available in this study (cf. McNicol, 1972). Consequently precedence in other research (cf. Gibson, et al, 1982; Redington, et al, 1981) suggested the use of a double criterion to define statistically significant discrimination and to increase the reliability of decisions regarding Ss' identification of different sleep states. This amounted to an alpha level of .01 for both the chi square and kappa statistics.

Ss' phenomenological descriptions were organized post-

experimentally by semantic similarity to permit predominantly qualitative evaluations of criteria. This was done to see if any were associated exclusively (and how often) with either of the two target sleep stages. Responses to question-probes across Training nights were evaluated using the chi square test for the independence of distributions. It is argued that since the REM/2 state discriminability reported in the literature is defined in distributional terms (Foulkes, 1985) then the nature of distributions should be assessed directly and without collapsing data to permit tests of mean difference. Moreover while non-normal or skewed distributions and large differences in variance could prove problematic for the latter type of analysis (eg. Moffitt, et al, 1982; cf. Howell, 1982), this type of finding would be important to highlight since the present study is interested in the discriminability of sleep states demonstrated in any fashion. To compensate for the restricted use of only a few response categories the BMDP computer program was instructed to collapse adjacent categories automatically if necessary.

Finally, when trials associated with recalls of experience were assessed at Post-test, the presence of recallable experience was determined by Ss' phenomenological descriptions. The presence of recallable experience across Training nights was indexed by Ss' responses to the 'Recall' question-probe (Appendix A4).

Accordingly, having had a sleep experience and the absence of a pre-wakeup experience are referred to as a 'recall' and 'non-recall', respectively.

2.3.2. Nighttime Data

All Ss slept 6 consecutive nights and all 8 planned wakeups per night and per S were executed successfully. Hence the following reflects a complete data set. All Tables and Figures referred to in the text are contained in Appendix B. At this time group data will precede descriptions of individual S data. Moreover, since the hypothesis is tested regarding the effects of training, then the following appraisal refers to the Post-test night results.

Combined subject data revealed that at Post-test (Table 1a) subjects as a group reliably discriminated target stages of awakening ($\chi^2 = 7.366$, $df = 1$, $p = .0066$; $\kappa = .52$, $df = 1$, $p = .0012$). Ss identified sleep stages 65 percent of the time, with the REM and Stage 2 hit rates being 72.5 and 57.5 percent, respectively. However this group analysis of multiple observations from more than one subject is not a recommended one since observations were not independent (cf. Howell, 1982). Therefore it was decided to stress individual subject data. This decision is reinforced by findings that individual subjects' state differences can vary when permitted (Section 1.3.). Idiographic evaluations of subject data (Table 1a) indicated that at Post-test, 4 of 5 Ss failed to reliably

distinguish target stages REM and 2. Only subject 2 (S2) successfully identified a state difference via discrimination judgments ($\chi^2 = 7.273$, $df = 1$, $p = .007$; $k = .625$, $df = 1$, $p = .004$). He successfully identified REM 100 percent of the time. The reasons for the discrepancy between nomothetic and idiographic results are elucidated below. Finally, Embedded Figures Test data for all Ss are included in Table 19.

2.3.2.1. Subject 2 (S2):

An evaluation of S2's Post-test phenomenological criteria (Table 2a) revealed that relative to Stage 2, REM was associated more often with a recallable experience and being actively involved in experience. Based on S2's phenomenological descriptions (Table 2a) a significantly higher recall rate (Table 7) was found for REM than Stage 2 ($\chi^2 = 5.77$, $df = 1$, $p = .01$). However when only trials associated with recallable experience were included it was found that having had a recallable experience neither facilitated successful discrimination of sleep stage (Table 1b) nor changed the nature of the state difference (Table 2b). This is in contrast with assessments which included all trials, that is, recalls and non-recalls grouped together (ie. Tables 1a & 2a, respectively).

Across Training nights S2's judgments failed to reliably discriminate target stages (Table 8a) despite the fact that he reported having had more instances of recallable experience in association with REM (Table 9a).

Moreover S2 reported having had an erection and rapid eye movements almost exclusively in association with REM.

S2's phenomenological descriptions (Table 9a) were corroborated by responses to a Recall probe (Table 7) in that experience was recalled significantly more often from Rem than Stage 2 ($\chi^2 = 10.667$, $df = 1$, $p = .0011$). However, having had a recallable experience neither facilitated successful discrimination of sleep state (Table 8b) nor changed the nature of the possible state difference (Table 9b). This is in contrast with assessments which included recalls and non-recalls grouped together (ie. Tables 8a & 9a, respectively).

Probe data revealed that (Table 14a & Figure 1) greater levels of 'continuity of experience' were associated with arousal from REM ($\chi^2 = 14.667$, $df = 5$, $p = .01$). Having had a recallable experience (Table 14b) did not facilitate the discrimination of sleep state using responses to question-probes when compared to the assessment which included recalls and non-recalls of experience grouped together (ie. Table 14a). On the other hand the description of a possible state distinction in terms of 'continuity of experience' was no longer significant.

2.3.2.2. Subject 4 (S4):

At Post-test S4's phenomenological criteria (Table 3a) revealed that relative to Stage 2, REM was associated more often with a recallable experience as well as with

experience that was more often vivid, explicit, colorful and populated by other characters.. Phenomenological descriptions indicated that REM/2 state discriminability was not defined by a difference in recall incidence (Table 7). Finally, having had a recallable experience neither facilitated successful discrimination of sleep state (Table 1b) nor changed the nature of the state difference (Table 3b). This is in contrast with assessments which included recalls and non-recalls grouped together (ie. Tables 1a & 3a, respectively).

Across Training nights S4's judgments (Table 8a) reliably distinguished target stages ($\chi^2 = 8.224$, $df = 1$, $p = .0041$; $k = .583$, $p = .0014$). Phenomenological descriptions (Table 10a) revealed that relative to Stage 2, REM was characterized more often by: a recallable experience; a sense of having had a dream-body as a dream character; greater involvement (eg. physical activity and interactions with others versus detached observation); longer, detailed, complex, continuous, clear, colorful and vivid experience; and, the presence of others.

Responses to a Recall probe (Table 7) corroborated phenomenological descriptions (Table 10a) that the REM recall rate exceeded Stage 2 incidence yet this difference was not statistically significant. Then, having had a recallable experience neither facilitated successful discrimination of sleep state (Table 8b) nor changed the nature of the state difference (Table 10b). This is in contrast with assessments which included recalls and non-

recalls grouped together (ie. Tables 8a & 10a, respectively).

S4's responses to question-probes (Table 15a & Figures 2-4) revealed that greater degrees of the following three characteristics were associated more often with REM: directness of physical contact ($\chi^2 = 17.6$, $df=6$, $p= .0073$); complexity of color ($\chi^2 = 17.333$, $df= 6$, $p= .0081$); sense of oneself ($\chi^2 = 16.8$, $df= 6$, $p= .01$). Having had a recallable experience (Table 15b) changed the discrimination of sleep state using responses to question-probes in that REM and Stage 2 experience was no longer discriminable in any terms. These data may indicate that differences found where recall and non-recalls were grouped together (ie. Table 15a) were a function of having considerable data associated with non-recalls from Stage 2.

2.3.2.3. Subject 1 (S1):

At Post-test S1's phenomenological descriptions (Table 4a) revealed that Stage 2 involved slightly more difficulty recalling an experience than did REM. Moreover REM/2 state discriminability was not defined by differences in recall incidence (Table 7). Then, having had a recallable experience neither facilitated successful discrimination of sleep state (Table 1b) nor changed the nature of the state difference (Table 4b). This is in contrast with assessments which included recalls and non-recalls grouped together (ie. Tables 1a & 4a, respectively).

Across Training nights S1's failure to discriminate

target stages (Table 8a) paralleled Post-test night performance. His phenomenological descriptions (Table 11a) revealed that only REM experiences were described as being real(istic) and believable as in waking life. Moreover his responses to a Recall probe (Table 7) indicated that recall rate differences did not distinguish sleep states. Finally, having had a recallable experience neither facilitated successful discrimination of sleep state (Table 8b) nor changed the nature of the state difference (Table 11b). This is in contrast with assessments which included recalls and non-recalls grouped together (ie. Tables 8a & 11a, respectively).

S1's responses to question-probes (Table 16a) indicated that a REM/2 state difference was not identified. Having had a recallable experience (Table 16b) exhibited a state difference with REM experience (Figure 5) being more complex than Stage 2 experience ($\chi^2 = 16$, $df = 6$, $p = .01$).

2.3.2.4. Subject 5 (S5):

At Post-test S5's phenomenological descriptions did not distinguish sleep states (Table 5a). Criteria were used infrequently and unsystematically. For instance, his phenomenological descriptions revealed that REM/2 state discriminability was not defined in terms of differences in recall incidence (Table 7). Moreover, having had a recallable experience neither facilitated successful discrimination of sleep state (Table 1b) nor changed the nature of the state difference (Table 5b). This is in

contrast with assessments which included recalls and non-recalls grouped together (ie. Tables 1a & 5a, respectively).

Across Training nights S5's discrimination judgments (Table 8a) failed to identify a state difference while the phenomenological descriptions (Table 12a) indicated that: 1) recallable experience as well as emotional/intense experiences characterized REM more often; and 2) feeling awake prior to experimental arousal more often typified Stage 2 experience. Moreover, REM/2 state discriminability was not defined in terms of a difference in recall incidence evidenced by responses to the Recall probe (Table 7). Then, having had a recallable experience neither facilitated successful discrimination of sleep state (Table 8b) nor changed the nature of the possible state difference (Table 12b). This is in contrast with assessments which included recalls and non-recalls grouped together (ie. Tables 8a & 12a, respectively).

S5's responses to question-probes (Table 17a) revealed that there were no question-probe bases by which REM and Stage 2 were discriminable. Having had a recallable experience (Table 17b) did not facilitate the discrimination of sleep state using responses to probes.

2.3.2.5. Subject 3 (S3):

At Post-test S3's phenomenological descriptions failed to distinguish sleep states (Table 6a). For instance, recall rates do not distinguish sleep states (Table 7).

Having had a recallable experience neither facilitated successful discriminations of sleep state (Table 1b) nor changed the nature of the state difference (Table 6b). This is in contrast with assessments which included recalls and non-recalls grouped together (ie. Tables 1a & 6a, respectively).

Across Training nights S5's discrimination judgments (Table 8a) failed to reliably identify a state difference while the phenomenological descriptions (Table 13a) indicated that REM experience tended to entail greater active involvement. Reports of 'being awake' were associated exclusively with Stage 2. Moreover REM/2 state discriminability was not defined in terms of a difference in recall incidence via responses to the Recall probe (Table 7). Having had a recallable experience neither facilitated successful discrimination performance (Table 8b) nor changed the nature of the state difference (Table 13b). This is in contrast with assessments which included recalls and non-recalls grouped together (ie. Tables 8a & 13a, respectively).

S3's responses to question-probes (Table 18a & Figure 6) revealed that REM exceeded Stage 2 in terms of the clarity of sensory experience ($\chi^2 = 17.8$, $df = 6$, $p = .0068$). Having had a recallable experience did not change the nature of the possible state difference (Table 18b). This is in contrast with the assessment which included recalls and non-recalls grouped together (ie. Table 18a). For

instance a greater level of clarity of sensory experience (Figure 7) continued to be associated with REM (Table 18b: $\chi^2 = 16$, $df = 5$, $p = .0068$).

2.4. Discussion

When the nomothetic results are assessed it appears that the hypothesis proposed in Study #1 was confirmed. That is, High recall males' sensitivity to internal states and relatively field-independent, cognitive style constituted the conditions enabling the successful identification of a REM/2 state difference. Nevertheless, since this analysis violated the assumption of the independence of observations then the more valid results from a statistical point of view are likely the idiographic ones. The latter will be discussed here. An examination of the contradictory outcomes of the nomothetic and idiographic analyses is provided in Section 3.4: together with similar findings from Study #2.

The idiographic results disconfirm the hypothesis for High recall males. At Post-test 4 of 5 subjects' data revealed that they were largely unable to identify a REM/2 state difference. In addition, there is considerable confidence associated with this conclusion. S2's successful discrimination performance was corroborated by a systematic and consistent association of different patterns of phenomenological criteria with each of the two types of sleep. Therefore the latter likely guided the former and these two agreed in indicating S2's awareness of a REM/2

state difference. The nature of the state difference was defined by REM involving a higher incidence of dreaming and active involvement in the experience.

For subjects 1, 3, 4 and 5 the inconsistent, unsystematic, infrequent or unrestricted association of phenomenological descriptions with REM and Stage 2 were associated with an inability to discriminate the two states. They indicated subjects' lack of awareness of a state difference at Post-test. For instance, phenomenological descriptions (eg. vividness) used almost exclusively with one of the sleep stages (ie. REM) were not used often enough by S4 to: 1) evince a state difference in experiential terms; or 2) guide successful discrimination performance. On the other hand subjects 1, 3 and 5's phenomenological descriptions were used unsystematically.

Overall, the agreement of multimethod data for each of the 5 subjects at Post-test makes it quite unlikely that these findings were chance occurrences. Moreover, having had a recallable experience did not change the results regarding subjects' ability to identify and describe a state difference. This means that irrespective of whether non-recalls were grouped with recalls of experience or not, the nature of experiential differences was the same. Finally, the data from the 4 subjects who failed to identify a state difference at Post-test indicated that REM and Stage 2 were neither distinguishable on the basis of recall incidence nor by differences in experiential quality.

S2 and S4's Training night data did not corroborate their respective Post-test night results. S2's discrimination judgments did not reliably distinguish target stages despite the fact that a significantly higher recall rate and experience that was more continuous were both associated with REM. These were indexed via question-probe. Therefore had S2 paid closer attention to and employed the criteria 'presence/absence of recallable experience' or 'continuity of experience', then he might have been able to guide successful discrimination performance. This would have paralleled Post-test discrimination performance and its description of a state difference. On the other hand, S4's phenomenological descriptions and responses to probes corroborated successful discrimination performance in indicating his awareness of a state difference. S4 may have failed at Post-test since he did not employ the same discriminators that he had used across Training nights and because he expressed having experienced extreme fatigue by the fourth night in the study.

Training night data from subjects 1, 3 and 5 agreed with their respective Post-test data. Phenomenological descriptions and the vast majority of probe-indexed responses corroborated failed discrimination performance in indicating the absence of awareness of a state difference. S5's probe data revealed that no state difference was defined. However, the fact that subjects 1

and 3 had not articulated 'complexity of experience' or 'clarity of sensory experience' as phenomenological criteria, respectively, indicated that they might have been able to use these to guide successful discrimination performance. This remains an untested hypothesis, however. Finally, having had a recallable experience did not significantly affect subjects' identifications or descriptions of sleep state differences.

Therefore, different answers to the REM/2 psychophysiology question were obtained depending on the data analytic perspective that was adopted. However the statistical violation associated with the nomothetic analysis likely makes the idiographic results the clearer of the two answers to the research question. Thus, the sensitivity to internal states and cognitive style appear to constitute conditions insufficient to enhance the effects of training in promoting subjects' identification of a state difference. This disconfirmation is in fact based on two findings.

First, only one subject identified a state distinction at Post-test. Second, there is some probe evidence that there were certain subjects for whom information was available regarding the correspondence or mapping of physiology onto phenomenology. However these subjects did not notice that a REM/2 state difference was expressed in these terms. This result supports Nisbett and Wilson's (1977) assertion that human subjects can often fail to notice the pertinence of information they themselves

provide. At this time the implications of these individual subject results are described.

Four subjects were unaware of a state difference at Post-test. Thus, the absence of a significant state-stage correspondence for subjects 1, 3, 4 and 5 likely indicates that different types of subject-identified experience or even different distributions of experience can not be reliably predicted or explained by variations in patterns of electrophysiological activity. This interpretation challenges the assumption (eg. Zimmerman, 1970) that phenomenology must differ because physiological sleep stages are readily distinguished. Consequently, interpretations of these covariation data such as isomorphism, parallelism, identity or reductionism are inappropriate. The phenomenology associated with the two sleep states was largely equivalent.

On the other hand, the fact that S2 provided covariation data suggesting a strong correspondence is evidence that interpretations such as psychophysiological parallelism may be applicable for this subject only. Physiology may be able to account for the nature of phenomenology as well as its occurrence since the dependence on REM for recallable experience reflects that the latter is constrained by the former. Thus, only S2's experiential states could be considered relatively discrete, at least for one characteristic (cf. Tart, 1975). Dreaming for S2 occurred almost exclusively in association

with REM.

The present results diverge from those reported by Antrobus and Antrobus (1967) and the differences could be attributed to a host of factors. The current study evaluated the nighttime and hence more stable sleep of High frequency recaller males. Antrobus and Antrobus assessed the less stable, day sleep of mid-range recall females. Moreover, these researchers did not employ a number of empirical controls which the present investigation did institute.

For instance, Antrobus and Antrobus included a biased distribution of wakeups ($REM > Stage2$) and likely because the majority of REM awakenings were performed late in the night. This means that Stage 2 arousals occurred more often early in the night and time of night likely constituted a threat to the internal validity of the Antrobus experiment. Subjects may have learned to respond 'REM' and 'Stage 2' when awakened late and early in the night respectively because they did receive performance feedback from the experimenters.

A question arises, then. If High recallers' level of sensitivity and cognitive style are insufficient to enhance the effects of training in promoting an identification of a state difference, then what might be sufficient for them to identify this distinction? One way to answer this question might then be to ask why the 4 subjects failed to demonstrate an awareness of a REM/2 experiential state difference while S2 succeeded. The

available evidence suggests that the most parsimonious explanation may be that there was no difference to identify for 4 of 5 subjects, at least in the terms highlighted by this study. One possible implication is that no amount of sensitivity or relatively field-independent cognitive style could ensure the demonstration of the existence of a distinction if no difference was extant. A state-dependence/independence construct will be used to illuminate this point.

Following the historical use of this construct (cf. Cohen, 1974; Koukkou & Lehmann, 1980, 1983; Lehmann & Koukkou, 1984), the present use can be defined as follows. State-dependence/independence amounts to the likelihood of the association of recallable experience or particular intensities of some experiential quality with sleep stages REM and 2. As such it is one index of the organization of sleep states, where organization refers to the differentiation and inter-relationship of these states (cf. Brent, 1984; Mahrer, 1978). For the purposes of this discussion 'differentiation' refers to the process of structure formation or multiplication which serves the specialization of subsystems (Langley, 1971). Thus the differentiation of sleep states REM and 2 refers to whether or not they are different or continuous with reference to the two possible bases for a REM/2 state difference: incidence of recallable experience or some quality(s) of recalled experience.

For example, if recallable experience (or some intensity of an experiential quality) is equally likely to occur in association with Stages REM and 2, then this similarity reflects state-independence for recallable experience. That is, presence of recallable experience for example is not dependent on, or compartmentalized to, the occurrence of one particular sleep stage. Thus this continuity of recallable experience across sleep types constitutes a many-to-one mapping of sleep stage onto experiential state. There is an equal 'preparedness' (Seligman, 1970) for recallable experience to occur in association with the sleep states in question.

On the other hand, if the occurrence of recallable experience depends on the occurrence of REM or Stage 2, then this significant difference reflects state-dependence (eg. REM-dependence) for recallable experience. That is, state-dependence indicates the compartmentalization and hence discontinuity of incidence of recallable experience. This constitutes a relatively one-to-one mapping of sleep stage onto experiential state.

From this perspective then the subjects in the present research can be classified on the basis of sleep state organization. S2 can be distinguished from the other subjects since across Post-test and Training nights he was dependent on the occurrence of REM for recallable experience. That is, recallable experience was compartmentalized to REM, indicating a discontinuity of sleep states for this characteristic. Moreover S2 used this

criterion at Post-test to guide discriminations and hence define the state distinction, indicating that he was aware of both the existence and nature of this state difference. Across Training nights he did not pay close enough attention to this recall difference indexed by responses to the Recall question-probe despite the fact that his sleep states were distinguishable in these terms. On the other hand the remaining subjects' sleep states were not distinguishable on this basis on Training or Post-test nights. Their state-independence for recallable experience reflected that their sleep states were continuous with reference to this characteristic. Moreover their phenomenological descriptions indicated that they were largely unaware of a state difference based on recall incidence.

State-dependence/independence regarding the experiential qualities of recalled experience delineated by subjects did not differentiate subjects as successfully, however. At Post-test subjects 1, 3 and 5 were largely state-independent for experiential qualities despite a few weak trends (eg. greater involvement in REM for subjects 2 and 3). This result was corroborated by Training night data. S2 was state-dependent for certain qualities while S4's weak state-dependence for a number of experiential characteristics was tempered by his failure to identify a state difference using judgments. Probe data revealed that when state differences were found, they reflected REM-

dependence for a greater intensity of the characteristics in question.

Consequently the best predictor of a subject's likelihood of demonstrating a state difference may be whether or not a difference (eg. REM-dependence) in recall incidence is extant. On the other hand, state-dependence for experiential qualities may help in the identification of a state difference since S4 used differences in experiential quality efficiently across Training nights. Moreover if a subject's data reflects state-independence for recallable experience and experiential qualities then there is likely no chance to demonstrate a difference since none exists in the terms revealed by this individual. Therefore the state-dependence/independence construct may be a relevant construct in explaining subjects' ability to identify a REM/2 state difference.

There is at present some research indicating that there are groups of subjects whose sleep state organization varies on the basis of state-dependence/independence for recallable experience. Moffitt et al (1982) have reported that relative to High recall males, Low recall males are REM-dependent for recallable experience. That is, while Low recallers' reported experience is relatively compartmentalized to REM, High recallers' REM and Stage 2 sleep states are more continuous with reference to the likelihood of recallable experience. Moreover, relative to High recallers, Low recall males' experience reports have also been found to be relatively REM-dependent for a

greater number of information units and words per report (Moffitt, et al, 1982).

Therefore the pertinent findings regarding the organization of sleep states indicate that High recallers tend to be less constrained by physiological state. This corroborates what was found in the present study for 4 of the 5 subjects whose sleep states tended to be continuous with reference to recallable experience. In the literature just described, Low recaller males' recallable experience and greater degree of report qualities tended to be REM-dependent, indicating that their experiential states are less continuous than are High recallers'. In a sense a continuity hypothesis is confirmed within sleep for High recallers but not for Low recallers (cf. Cohen, 1979).

Following this discussion the research discussion adopted in Study #2 involves the contrast of High and Low recallers. The theoretical disconfirmation obtained in the first study as well as the preceding discussion together suggest that the initial theoretical position presented in Chapter 1 was overly simple. Sensitivity to internal states and a field-independent cognitive style appear to be conditions insufficient to promote subjects' identification of a REM/2 state difference. Sleep state organization for recallable experience likely exceeds these other two attributes in importance for the task of discriminating sleep states. The reason is that state organization indexes in structural terms whether or not a state difference

exists.

Therefore the theoretical position was revised to include this factor and it yielded the following research direction. Since High and Low recallers have been shown to vary in terms of their sleep state organization, it was decided to investigate this question: how does being a High versus Low recaller moderate subjects' ability to identify a REM/2 state difference? Hypotheses are stated in Section 3.1.

The idiographic results are suggestive. Therefore, while a nomothetic assessment can provide an overall picture of subjects' performance, the result it yields should be assessed in light of individual subject data. The reason is that, the latter highlights how psychophysiological relations can vary across subjects.

However, some of the other practices in this first study require rectification before they can be included in Study #2. All subjects complained of fatigue at Final Inquiry due to the number of nights. For instance, over the last 2-3 nights each subject demonstrated an increasing difficulty in being awakened as well as remaining awake. The six nights proved too many for the High recallers for whom inclusion in wakeup studies is typically not a negative experience (cf. Armitage, 1986; Moffitt, et al, 1985a). Moreover the performance demands placed on Ss were unlike those in most dream research since despite instructions to the contrary (see Appendix A5), subjects expressed having felt pressured to perform well. This is an

important issue since the plan is to include Low recallers in Study #2. A modification of the experimental design is required for the following reason.

Low recallers would probably be overwhelmed by six nights in light of the fact that they tend to experience 'evaluation apprehension' in sleep studies:

..being a subject in our experiments is harder for the lows than the highs. The lows have sometimes apologized to the experimenters when they had no dream to report. Our interpretation of the differences we observe among these subjects in terms of their organismic response to participating in a psychophysiological study of dreaming is that the low recallers view their performance in this situation as a test of competence in a skill in which they think they are not strong. The high and low recallers about whom we have been talking are males. (Moffitt, et al, 1985b, p. 9)

Moreover Armitage (1986) has suggested that in her study Low recallers were more easily perturbed by involvement in her sleep experiment. She claims that "high recallers are less affected by the task demands, ... and the general experimental environment than are low recallers such that no disruption in underlying biological rhythms occurs when high recallers enter the experimental situation" (p. 174).

Therefore to attenuate the possible magnification of competency concerns in Low recallers, a number of modifications are planned. The design is changed to accomodate the fact that the number of nights is decreased as well as the fact that data from one type of night (eg. Training) can not meaningfully explicate responding on a second type of night (eg. Post-test). The remainder of the changes are described in Chapter 3.

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A number of implications of Study #1 are examined in the discussion of Study #2 (Section 3.4.) since these pertain to findings which are common to the two investigations. These include an assessment of results in light of Gibson et al's (1982) findings. Finally, the fact that the present results did not replicate findings that a REM/2 state difference is defined in distributional, probe based terms will also be addressed at that time. Attention is now turned to Study #2.

CHAPTER THREE

3.1. The Research Questions

The present study investigates the following question. Since these subjects have been found to differ on the basis of a REM/2 state organization for incidence of sleep experience, then how do High and Low frequency recaller males differ in their ability to identify the existence and nature of a REM/2 state difference? The answer is achieved by implementing a change in experimental design over Study #1. One practice/acclimatization and 3 Test nights are planned over 4 consecutive nights.

Training will once again involve educating subjects' attention and vocabulary to potential discriminators of the two sleep states. To compensate for the loss of separate Training nights, and because 4 of 5 subjects in Study #1 failed to identify a state difference at Post-test, training is intensified. This amounts to having subjects spend more time with training materials as well as coming to the laboratory at least 2 days before their first sleep session. At this time the information is discussed with the experimenter. Feedback is provided across the 4 nights.

As in Study #1, data are elicited using the discrimination-verification strategy and then they are analyzed nomothetically and idiographically. All measurement operations are included on each night. One benefit of this change in design is the decreased number of analyses performed per subject since only one type of night (ie. Test) is assessed. The following are the specific

questions investigated in Study #2:

1. Are subjects aware of the existence of a REM/2 experiential state difference which co-occurs with the REM/2 sleep stage distinction? That is, can subjects successfully discriminate target stages of awakening?
2. Are subjects aware of the nature (ie. phenomenological criteria) of a REM/2 experiential state difference? That is, are there different patterns of phenomenological criteria associated with the two sleep states?
3. Does subjects' awareness of the nature of a state distinction corroborate their awareness of the existence of a REM/2 state difference? That is, do patterns of phenomenological criteria corroborate subjects' discriminations of target stages in indexing the existence of a REM/2 state difference?
4. When subjects' responses to a direct probe are examined, is there a difference in the incidence of pre-awakening experience which distinguishes the two sleep states?
5. a. Does having had a pre-awakening experience affect subjects' awareness of the existence of a state difference?
b. Does having had a pre-awakening experience affect subjects' awareness of the nature of a state difference?
6. Are subjects aware of all of the possible bases for a REM/2 experiential state difference?
a. That is, is there information of which subjects might be unaware and which successfully identifies the existence and nature of a state difference?
b. Does having had a pre-awakening experience affect the demonstration of the existence and nature of a state difference of which subjects might be unaware?

Following the review of the literature a number of secondary questions are asked. Do High and Low recallers differ in terms of their respective sensitivities to internal states? Do High and Low recallers differ on the basis of their field-dependent/independent cognitive style? One problem with Study #1 was the failure to include a measure of sensitivity to internal states. This is

rectified in Study #2.

Based on the discussion in Section 2.4., the following hypotheses are tested with reference to subjects' data collected over the final three, Test nights:

1. Low recallers are more likely to identify the existence of a REM/2 state distinction than High recallers. The reason is the former's REM-dependent state organization for recallable experience is likely the clearest difference between the two states. However, Low recallers need not be able to articulate the awareness of the nature of this difference for his responses (ie. Experience probe) to show that the difference is defined in these terms.
2. High and Low recallers are distinguishable on the basis of state-independent and REM-dependent sleep state organizations for recallable experience, respectively.
3. Following the results of Study #1, the only High recallers to identify a state difference will be REM-dependent for recallable experience. This hypothesis competes with #5.
4. Low recallers' successful identification of a state difference will be associated with an awareness of a REM-dependent sleep state organization for recallable experience.
5. High recallers' successful identification of a state difference could only be associated with an awareness of a state-dependent organization for experiential quality.
6. High recallers will demonstrate a greater sensitivity and openness to internal states than Low recallers.
7. High recallers will demonstrate a more field-independent cognitive style than Low recallers.

3.2. Method

3.2.1. Design

A modified two group design was adopted to permit the contrast of High and Low recallers using nomothetic analyses as well as following idiographic analyses of individual subject data. Each subject slept 4 consecutive nights in the laboratory with the first, Practice night

yielding data that were excluded from analysis. The final 3 nights constituted Test sessions. Consecutive nights were included to promote massed practice.

3.2.2. Subjects (Ss)

Five (5) High frequency recaller males were included, with each currently recalling one dream per night, and with rare exception. Five (5) Low recaller males were selected on the basis of current recall of at most one dream per month. Ss ranged in age between 19 and 26 years. All ten Ss were Introductory Psychology students contacted in class and each required Participation Credits to pass their course (Appendix C1). All Ss were right-handed males. Reasons are described in Section 2.2.2.

The complete data set obtained in Study #1 reinforced the value of selecting Ss who sleep 7-8 hours per night to sustain the number of planned arousals. This practice was repeated in the present study. Moreover Ss were asked to abstain from alcohol and drug consumption as well as atypical napping to preclude possible sleep disruption.

3.2.3. Apparatus

The equipment facilitating identification of sleep stages included: Grass EEG preamplifiers with 60 Hz filters; dual beam Tektronix oscilloscope; Sanyo audio cassette recorder; LSI-1173 computer with electrophysiological signal display and data storage programs; color video adapter; and, color video monitor.

Electrophysiological signal data were transferred to streamer, back-up tapes after each session. On-line display of electrophysiology permitted sleep stage identification using Rechtschaffen and Kales' (1968) conventions. Ss slept in a 12' x 9' x 10', air-conditioned sleep room equipped with an intercom for communication during the night. All verbal exchanges were audiotaped.

3.2.4. Procedure

A phone call followed up the initial contact and basic information was provided for prospective Ss (Appendix C2). Ss meeting the criteria were scheduled to sleep 4 consecutive nights. All Ss accepted to come to the sleep laboratory a minimum of two days before they were expected to sleep their first night. At this time Ss were given a complete tour of the facilities and sleep room to relax Ss. Ss were then asked to: 1) read the description of REM/2 state discriminability (Appendix C3); and 2) discuss this information with the E to ensure he understands the material. At this time Ss were told what was expected of them during the course of the study. Ss were encouraged to request clarification.

As in Study #1, the E stressed that the information provided in the literature summary might not be any more useful than Ss' own criteria; and, it was suggested that they use whatever works. Ss were told they could take this summary with them and that they should study it at least four or five times before coming to the laboratory. Ss were

then trained to use Human Figure Drawings as if they constituted a 7-point scale that could be used to rate pre-arousal experience upon request at night (Appendix C4). This task was employed since ancillary data collected in Study #1 (Appendix B, Table 19) showed that each of the 5 subjects selected a Human Figure Drawing representing a higher level of self-nonsel self differentiation for REM than Stage 2. These data are suggestive of a possible basis for a state difference. Precedence for a matching method in psychophysiological dream research comes from Rechtschaffen and Buchignani (1983). Finally, Ss were given the Private Self-consciousness sub-questionnaire embedded within the Self-Consciousness questionnaire (Appendix E) and they were asked to return it within one week. A time was set for the first sleep session.

Before the hook-up on each night the S was asked whether he required any clarification regarding the literature summary or the nature of his tasks. The hook-up procedure was the same for all nights. The electrode montage was modified from that of Study #1. Since sleep stages are electrophysiological events whose onset may become manifest at varying times across the cortex (cf. Buchsbaum, Mendelson, Duncan, Coppola, Kelsoe & Gillin, 1982), then parietal site recordings were included to ensure the experimenter's reliable identification of target stages. Continuous, standard monopolar, polygraph recordings were made at EEG sites C3-C4 (centrals) and P3-P4 (parietals), with linked references. Bipolar EOG (E1-E2)

and two submental EMG sites were recorded as well. Beckman miniature Ag/AgCl EEG electrodes were attached externally using: Grass EC-2 electrode paste, and electrode patches. EOG, EMG, reference (two ear lobes) and ground (forehead) electrodes were affixed using adhesive collars, synapse conductive electrode cream, and electrode patches.

Following the hook-up on each night the Ss were put to bed and the lights turned off. Experimental awakenings followed a specific schedule (Appendix C5), with each planned arousal being the 'first' or 'next' occurrence of the designated target stage. Each wakeup was initiated by a firm voice call for the reasons described in Section 2.2.4. Upon awakening Ss were asked to remain still and with eyes closed. Finally, a single wakeup protocol was utilized across all nights (Appendix C9), including the original question-probes (Appendix A7) and the differentiation question-probe (Appendix C4). Ss were unhooked in the morning following arousal at a time designated the night before. Inquiry questions were asked before the S left in the morning (Appendix C6). The Embedded Figures Test (Form A) was administered on Night 3 and before the hook-up (Appendix A9). Following the Inquiry and a Final Inquiry (Appendix C7) after the fourth session, Ss were briefed as to the purpose of the study.

3.2.5. Conventions Defining Experimental Awakenings

Eight wakeups were scheduled per night per S, with four from each type of sleep. Two REM and Stage 2

awakenings were planned for each half of the night to control for a possible time of night confound. Stage REM with at least one rapid eye movement burst every 2 minutes and Stage 2 were selected as the target stages to maximize REM/2 discriminability electrophysiologically. A minimum of 5 minutes and a maximum of 8 minutes were required to signal an experimental awakening. One implication of the data supporting the functional state shift theory (cf. Koukkou & Lehmann, 1983; Lehmann & Koukkou, 1984) is that if a S were to exit a target stage and enter a second one or experience excessive movement before entering wakefulness, then the S might 'lose' a pre-wakeup. For this reason the additional conventions were used to deal with unexpected situations (Appendix A13).

3.2.6. Operations

Discrimination judgments were solicited to evidence Ss' awareness of the existence of a state difference. Certainty ratings were intended to promote Ss' focussed attention on discriminations. Phenomenological descriptions were elicited to index Ss' awareness of the nature of the difference. Question-probes were used to highlight state differences of which the S might have been unaware. Probes were used irrespective of the availability of a recallable experience. Whether or not a subject had a pre-wakeup experience was determined by response to a question-probe. The 'availability' and the 'recallability' of sleep experience were assessed separately. The goal was to

provide Ss with an opportunity to use these independently as possible discriminators of state. Thus, a 'recallability of sleep experience' probe was developed (Appendix C9) as was a post hoc index of the 'permeability or facilitative nature of the sleep-wake boundary'. The latter was created using combinations of responses to the sleep experience and recallability probes.

A very facilitative boundary (a score of '6') is indexed by having had an experience which is easily recalled. A 'likely facilitative' boundary ('5') reflects the absence of an experience yet a sense that an experience could have been recalled easily. 'Moderately facilitative' ('4') refers to having had an experience that could be recalled with some difficulty. 'Minimally facilitative' ('3') indicates the absence of a sleep experience yet the sense that had one occurred it would have been recalled with some difficulty. 'Contentless' ('2') reflects having had an experience which could definitely not be recalled. Low recallers have been found to provide contentless reports more often than High recallers (cf. Goodenough, 1967). 'No experience' ('1') means the absence of an experience and no sense of the possible recall of any experience.

Form A of the Embedded Figures Test was included as a measure of field-dependence/independence. The Private Self-consciousness subscale of the Self-consciousness scale was included to index subjects' sensitivity or openness to

internal experience (cf. Penigstein, Scheier & Buss, 1975). Finally, Fatigue and Sleep quality ratings were elicited during Inquiry sessions to index whether subjects were disturbed by the experimental regimen (Appendix C6).

3.3. Results

The data treatment conventions employed in Study #1 were also used in this study (Section 2.3.1.). The presence of recallable experience was determined by subjects' responses to the Experience probe. The test of the homogeneity of chi square and two-tailed t-tests were employed to assess group differences.

Each subject slept 4 consecutive nights and all 8 planned wakeups per night were achieved for all subjects except S7. His illness towards the end of Test night 3 precluded the final 2 awakenings. Since the first night was a practice session for each subject, only data across the final 3 Test nights were analyzed. All Tables and Figures mentioned in the text regarding Study #2 are contained in Appendix D. As in Study #1 an overall summary of the results precedes descriptions of individual subject data.

3.3.1. Reliability Data

Inter-judge reliability was assessed using a consensus method. The independent judge practiced on subjects' Baseline night data and then proceeded directly to the final evaluation of Test night data. The judge was experienced with the sleep stage scoring procedure outlined by Rechtschaffen and Kales (1968) as well as the

conventions adopted in the present research (Section 3.2.5.). The Test night, electrophysiological data were assessed with only the epoch numbers of target stages which signalled experimental awakenings being provided for the second judge (N= 238). Thirty seven additional sleep stages were included as 'distractor' trials. These were REM and Stage 2 trials that had not been used to signal arousals. Only those data associated with experimental wakeups were analyzed, however.

The kappa value for inter-judge reliability was extremely significant and it indicated strong agreement between the judge and the experimenter ($\kappa = .946$, $df = 1$, $p = .0000$). The two judges agreed on 230 of 238 total trials (96.6%) which amounted to 116 of 119 REM trials (97.5%) and 114 of 119 Stage 2 wakeups (95.8%). Of the 8 disagreements, agreement was reached on 6 following judges' joint assessment of electrophysiological data. The remaining 2 disagreements were arousals associated with what the experimenter called 'Stage 2'. Both occurred on the same night when High recaller S7 became ill during the sleep session. However, since S7's discrimination and phenomenological data did not even approach a level of success in identifying a state difference then it was decided to keep the data associated with these 2 awakenings in the analyses. Both trials were associated with correct discriminations performed by the subject.

3.3.2. Group Discrimination and Recall Data:

Across Test nights High recallers as a group (Table 1a) reliably distinguished target stages of awakening ($\chi^2 = 11.379$, $df = 1$, $p = .0007$; $k = .506$, $df = 1$, $p = .0014$) as did Low recallers as a group ($\chi^2 = 6.541$, $df = 1$, $p = .01$; $k = .472$, $df = 1$, $p = .009$). Overall, High recallers succeeded on 65.5 percent of trials while their REM performance (74.6 %) exceeded that of Stage 2 (56 %). Low recallers' overall percent correct was 61.5 %. REM and Stage 2 rates were very similar (60 % & 63.3 %, respectively). However, the test for the homogeneity of chisquare revealed a nonsignificant difference between High and Low recallers' patterns of correct and incorrect responding for REM and Stage 2.

High recallers' total, REM and Stage 2 recall rates in Study #2 were 66.7, 80 and 53.3 percent, respectively. Low recallers' rates were 57.5, 60 and 50 percent, respectively. As a group, High recallers' recall incidence (Table 12) did distinguish target stages ($\chi^2 = 9.937$, $df = 1$, $p = .0016$) while Low recallers' did not. The test of the homogeneity of chisquare revealed that patterns of recall incidence (Table 12) did not differentiate High and Low recaller groups.

3.3.3. Idiographic Discrimination Data

Across Test nights (Table 1a) only High recaller S10 ($\chi^2 = 16.667$, $df = 1$, $p = .0000$; $k = .833$, $df = 1$, $p = .0002$) and Low recaller S3's discrimination judgments ($\chi^2 = 8.711$, $df =$

1, $p = .0032$; $k^2 = .583$, $df = 1$, $p = .0018$) reliably identified target stages of awakening. For S10, both REM and Stage 2 were equally likely to be identified correctly (Table 1a). For S3, Stage 2 was more likely to be identified correctly.

3.3.4. Data for High Recallers (Ss 4, 6, 7, 8, 10)

Subject 4 (S4):

Across Test nights an evaluation of S4's phenomenological criteria associated with judgments (Table 5a) revealed that relative to Stage 2, REM was associated more often with reports of a long, continuous experience and deeper sleep. Only the depth of sleep criterion was employed relatively often and its use did not ensure the successful identification of target stages. Responses to the Experience probe (Table 12) indicated that S4 was state-independent for sleep experience. Finally, having had a sleep experience neither facilitated the successful discrimination of sleep state (Table 1b) nor changed the nature of the state difference (Table 5b). This is in contrast with assessments which included all trials, that is, undifferentiated for presence versus absence of a sleep experience (ie. Tables 1a & 5a, respectively).

S4's responses to question-probes (Table 16a & Figure 1) revealed that a greater degree of dreamer-sleepworld differentiation characterized REM than Stage 2 ($\chi^2 = 14.857$, $df = 4$, $p = .005$). Having had a sleep experience did not change the possible nature of the state difference (Table

16b). This is in contrast with the assessment which included all trials (ie. Table 16a). REM continued to exceed Stage 2 experience (Figure 2) for level of dreamer-sleepworld differentiation ($\chi^2 = 14.529$, $df = 4$, $p = .0058$).

Subject 6 (S6):

Across Test nights an evaluation of S6's phenomenological criteria associated with judgments (Table 7a) revealed that REM and Stage 2 were basically indistinguishable. Responses to the Experience probe (Table 12) indicated that S6 was state-independent for sleep experience. Finally, having had a sleep experience neither facilitated the successful discrimination of sleep state (Table 1b) nor changed the nature of the state difference (Table 7b). This is in contrast with assessments which included all trials (ie. Tables 1a & 7a, respectively).

S6's responses to question-probes (Table 18a) revealed that REM and Stage 2 were not distinguishable. In addition, having had a sleep experience did not change the possible nature of the state difference (Table 18b). This is opposed to conditions which included all trials (ie. Table 18a).

Subject 7 (S7):

Across Test nights S7's phenomenological criteria (Table 8a) revealed that REM and Stage 2 were basically indistinguishable. Moreover responses to the Experience probe (Table 12) indicated that S7 was state-independent for sleep experience. Finally, having had a sleep experience neither facilitated the successful

discrimination of sleep state (Table 1b) nor changed the nature of the state difference (Table 8b). This is in contrast with assessments which included all trials (ie. Tables 1a & 8a, respectively).

S7's responses to question-probes (Table 19a & Figure 3) revealed that REM experience was associated with a greater clarity of sensory experience ($\chi^2 = 16$, $df = 4$, $p = .003$). Having had a sleep experience did not change the possible nature of the state difference (Table 19b). This is in contrast with the assessment which included all trials (ie. Table 19a). REM continued to exceed Stage 2 (Figure 4) for clarity of sensory experience ($\chi^2 = 16$, $df = 3$, $p = .0011$).

Subject 8 (S8):

Across Test nights S8's phenomenological criteria (Table 9a) revealed that relative to Stage 2, REM was associated only slightly more frequently with reports of an intense, vivid and 'real' experience. Responses to the Experience probe (Table 12) indicated that S8 was state-independent for sleep experience. Finally, having had a sleep experience neither facilitated the successful discrimination of sleep state (Table 1b) nor changed the nature of the state difference (Table 9b). This is in contrast with assessments which included all trials (ie. Tables 1a & 9a, respectively).

S8's responses to question-probes (Table 20a & Figures 5-6) revealed that each of these two characteristics

demonstrated a greater intensity for REM than Stage 2: recallability of sleep experience ($x^2 = 8.416$, $df = 2$, $p = .01$); or, the permeability of facilitative nature of the sleep-wake boundary ($x^2 = 10.473$, $df = 3$, $p = .01$). Then, having had a sleep experience did not change the possible nature of a state difference (Table 20b). This is in contrast with the assessment which included all trials (ie. Table 20a). REM remained associated with greater levels (Figures 7-8) of the recallability of sleep experience ($x^2 = 10.248$, $df = 2$, $p = .006$) and the permeability or facilitative nature of the sleep-wake boundary ($x^2 = 10.248$, $df = 2$, $p = .006$).

Subject 10 (S10):

Across Test nights S10's phenomenological criteria (Table 11a) revealed that relative to Stage 2, REM was associated more often with reports of dreaming, the presence of the S-as-dreamer, and experience that was visual, realistic and clear. Responses to the Experience probe (Table 12) indicated that S10 was REM-dependent for sleep experience ($x^2 = 16.667$, $df = 1$, $p = .0000$). Then, having had only one sleep experience in association with Stage 2 (Table 1b) reinforced the REM-dependent status of this S for sleep experience. Finally, having had a sleep experience did not change the nature of the state difference (Table 11b). This is in contrast with assessments which included all trials (ie. Table 11a).

S10's responses to question-probes (Table 22a &

Figures 9-16) revealed a REM-dependence for higher intensities or magnitudes of each of these characteristics: feeling intensity ($x^2 = 15.444$, $df = 5$, $p = .0086$); number of scenes ($x^2 = 16.533$, $df = 5$, $p = .0055$); time spent participating actively ($x^2 = 17.333$, $df = 5$, $p = .0039$); length of the experience ($x^2 = 18.333$, $df = 6$, $p = .0055$); vividness of the sleep/dreamworld ($x^2 = 18.667$, $df = 6$, $p = .0048$); dreamer-sleepworld differentiation ($x^2 = 15.111$, $df = 5$, $p = .0099$); recallability of the sleep experience ($x^2 = 17.133$, $df = 2$, $p = .0002$); and, the permeability or facilitative nature of the sleep-wake boundary ($x^2 = 17.133$, $df = 2$, $p = .0002$).

Having had a sleep experience changed the possible nature of the state difference (Table 22b). Having had only one Stage 2 sleep experience probably precipitated the loss of bases defining a state difference from assessments which included all trials (Table 22a).

3.3.5. Data for Low Recallers (Ss 1, 2, 3, 5 & 9)

Subject 1 (S1):

Across test nights S1's phenomenological criteria (Table 2a) revealed that relative to Stage 2, REM experience tended to involve reports of an interaction with other sleep characters and being awake less often prior to experimental awakening. However these descriptions were used infrequently. Responses to the Experience probe (Table 12) indicated that S1 was state-independent for sleep experience. Finally, having had a sleep experience neither

facilitated the successful discrimination of sleep state (Table 1b) nor changed the nature of the state difference (Table 2b). This is in contrast with assessments which included all trials (ie. Tables 1a & 2a, respectively).

S1's responses to question-probes revealed that there was no basis for a possible state difference (Table 13a). Moreover, having had a sleep experience did not change the possible nature of the state difference (Table 13b) when contrasted with the assessment which included all trials (ie. Table 13a).

Subject 2 (S2):

Across Test nights S2's phenomenological criteria (Table 3a) revealed that REM and Stage 2 were basically indistinguishable. Responses to the Experience probe (Table 12) indicated state-independence for sleep experience. Finally, having had a sleep experience neither facilitated the successful discrimination of sleep state (Table 1b) nor changed the nature of the state difference (Table 3b). This is in contrast with assessments which included all trials (ie. Tables 1a & 3a, respectively).

S2's responses to question-probes (Table 14a) revealed that REM and Stage 2 were not distinguishable. Moreover, having had a sleep experience did not change the possible nature of the state difference (Table 14b). This is in contrast with the assessment which included all trials (ie. Table 14a).

Subject 3 (S3):

Across Test nights S3's phenomenological criteria (Table 4a) revealed that relative to Stage 2, REM entailed more reports of experience where the dreamer was more directly involved in the action (eg. active participation), and, awakenings that were easy. However, responses to the Experience probe (Table 12) indicated that S3 was state-independent for sleep experience. Finally, having had a sleep experience maintained the successful identification of sleep state (see Table 1b: $\chi^2 = 7.987$, $df = 1$, $p = .0047$; $k = .569$, $df = 1$, $p = .0051$) and did not change the nature of the state difference (Table 4b). This is in contrast with assessments which included all trials (ie. Tables 1a & 4a, respectively).

S3's responses to question-probes (Table 15a & Figure 17) revealed that more time was spent participating actively in REM than Stage 2 ($\chi^2 = 14.371$, $df = 5$, $p = .01$). Having had a sleep experience changed the possible nature of the state difference (Table 15b) from the assessment which included all trials (ie. Table 15a). REM and Stage 2 were not distinguishable in any terms.

Subject 5 (S5):

Across Test nights S5's phenomenological criteria (Table 6a) revealed that he reported having felt less tired and more totally asleep in association with REM. Responses to the Experience probe (Table 12) revealed that S5 was state-independent for sleep experience since only one

sleep experience was experienced by this S. Therefore, having reported only one sleep experience precluded an assessment of the effects of the availability of sleep experience on the ability to discriminate sleep states or to define the nature of the state difference (Tables 1b & 6b). Thus, the incidence of sleep experience did not distinguish sleep states.

S5's responses to question-probes (Table 17a) indicated that REM and Stage 2 were not distinguishable in any terms. Moreover, having had only a single (ie. Stage 2) experience indicates that REM and Stage 2 were not distinguishable (Table 17b).

Subject 9 (S9):

Across Test nights S9's phenomenological criteria (Table 10a) revealed that reports of 'being awake' were associated more often with Stage 2 than REM. Responses to the Experience probe (Table 12) indicated that S9 was state-independent for sleep experience. Finally, having had a recallable experience did not facilitate the successful identification of sleep state (Table 1b) yet it did change the nature of the description of a state distinction. That is, REM and Stage 2 were no longer discriminable in terms of depth of sleep (Table 10b) when contrasted with the assessment which included all trials (ie. Table 10a).

S9's responses to question-probes (Table 21a) revealed that REM and Stage 2 were not distinguishable. Having had a sleep experience did not change the possible nature of

the state difference (Table 21b). This is in contrast with the assessment which included all trials experience (ie. Table 21a).

3.3.6. Summary Analyses of Subjects

This section takes as its focus the analysis of subjects, not raw discrimination or phenomenological data. Following idiographic analyses (Sections 3.3.4. & 3.3.5.) Ss were categorized for success/failure to identify a state difference as well as REM/2 state organization for incidence of sleep experience. These data were then subjected to binomial test where appropriate. A Table summarizing individual subject data appears on the next page. The following descriptions pertain to these data.

Low and High recallers were equally likely to fail to identify a REM/2 state difference since one in five of each type of subject succeeded ($\chi^2 = 0$, $df = 1$, $p = 1$). High and Low recallers were not distinguishable on the basis of sleep state organization since 9 of 10 subjects were state-independent for sleep experience ($\chi^2 = 1.111$, $df = 1$, $p = .2918$). Moreover, for Low recallers the ability to identify a REM/2 state difference was independent of the type of state organization for sleep experience. All 5 subjects were state-independent for this characteristic. Finally, for High recallers the ability to identify a REM/2 state difference was also independent of type of sleep state organization for sleep experience ($\chi^2 = 5$, $df = 1$, $p = .03$).

Despite trends in the expected directions High and Low

SUMMARY TABLE OF IDIOGRAPHIC RESULTS

<u>Subject</u>	<u>Type of Subject</u>	<u>Successful Judgments?</u>	<u>State organization for:</u>		<u>Number Significant Probe</u>
			<u>Recallable Experience</u>	<u>Experiential Quality</u>	
S4	HIGH	NO	SI	SI	1
S6	HIGH	NO	SI	SI	
S7	HIGH	NO	SI	SI	1
S8	HIGH	NO	SI	SI	1
S10	HIGH	YES	REM-DEP	REM-DEP	1
S1	LOW	NO	SI	SI	1
S2	LOW	NO	SI	SI	
S3	LOW	YES	SI	DEP	1
S5	LOW	NO	SI	SI	
S9	LOW	NO	SI	SI	

* SI= State-independent for this quality

REM-DEP= REM-dependent for this quality

DEP= REM-dependent & Stage 2-dependent for different qualities

recallers (Table 23) were not distinguishable on the basis of scores reflecting sensitivity to internal states ($t(1,8) = 1.49$, $p = .174$) or field-independent cognitive style ($t(1,8) = 2.04$, $p = .0756$). Large differences in variance between recaller groups likely contributed to the second result (Levene's $F(1, 8) = 5.13$, $p = .0534$). The difference approached significance, with Low recallers' level of variation exceeding that of High recallers.

Finally, based on rating data obtained at Inquiry (Table 23) means were calculated for each subject for Fatigue and Sleep Quality ratings obtained each of the last three mornings. It was found that High and Low recallers coped with the experimental situation equally well. That is, they reported having felt equally rested ($t(1,8) = 0.45$, $p = .6651$) and having slept equally well ($t(1,8) = 0.2$, $p = .8432$). The results are discussed next.

3.4. Discussion

Nomothetic analyses of discrimination judgments revealed that the High and Low recaller groups had each identified the existence of a REM/2 state difference. Moreover these two groups did not differ significantly in terms of their percentages of correctly identified states. As well, High recallers more readily identified REM than Stage 2 arousals while Low recallers' REM and Stage 2 hit rates were very similar. Consequently, from the nomothetic perspective most of the hypotheses tested in Study #2 were not supported.

Low recallers as a group were not more successful than High recallers in identifying a REM/2 state difference. Low recallers as a group were not more likely than High recallers to identify a state difference (Hypothesis 1). When recall rates were assessed High and Low recallers were not distinguishable on the basis of a REM/2 state organization for sleep experience. In fact High and Low recallers were REM-dependent and state-independent for sleep experience, respectively (Hypothesis 2). This result contradicts Moffitt et al's (1982) finding. Possible reasons for this difference are discussed below. Moreover, Hypotheses 4 and 5 were also disconfirmed by these data since: 1) as a group, High recallers' successful identification of a state difference was associated with a REM-dependent state organization for sleep experience; and 2) as a group, Low recallers' successful identification of a state difference was associated with a state-independent organization for sleep experience.

Hypothesis 6 regarding the sensitivity to internal states was also not confirmed. Although the difference was in the expected direction it represented a small discrepancy. Nevertheless, considering the highly significant difference between High and Low recallers found by Purcell (1987) using the same Private self-consciousness items, one explanation for the present finding may be forwarded. Purcell's differences were based on a large number of observations (N= 94) while Study #2 tested only 10 subjects. Therefore the scale may be reliable and

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valid indicator of sensitivity to internal states yet the small N may have precluded a significant difference.

Hypothesis 7 regarding cognitive style was not confirmed for the following reason. While High recallers as a group were clearly more field-independent than Low recallers, the latter's responding exhibited greater variation than the former's. A larger number of subjects might promote this mean difference in light of heterogeneous variances. Purcell's (1987) cognitive style data suggest the feasibility of this interpretation. She replicated earlier findings for the difference in field-independent cognitive style using a large number of subjects.

All results but the last two are clearly problematic because the assumption of the independence of observations was violated for the tests of chi square. Therefore these group data may have been influenced by subjects exhibiting extreme patterns of response. This issue will be discussed below. Consequently the following idiographic assessments likely yielded the more valid results. These are discussed at this time.

Discrimination judgment data revealed that only 2 of 10 subjects provided data reflecting their awareness of a REM/2 state difference: High recaller S10 and Low recaller S3. Moreover, each of these two subjects' successful discrimination judgment performance was corroborated by a systematic and consistent association of different patterns

of phenomenological criteria with each of the two types of sleep. Therefore these descriptions likely, guided identifications of sleep state. S10 was REM-dependent for recallable experience and he was aware of this definition of a state difference. In fact he responded 'REM' each time he had a sleep experience. On the other hand there were additional, probe bases for a possible state difference of which S10 was likely unaware. He did not articulate these criteria.

S3 was state-independent for sleep experience. Therefore he was forced to use differences in experiential quality to successfully discriminate sleep states. This was what he achieved since he had recalls on 23 of 24 awakenings. Finally, S3 was aware of the only possible, probe basis for a state difference. Overall, the convergence of these two subjects' respective, multimethod data make it unlikely that either of these findings was a chance occurrence.

For High recaller S6 as well as Low recallers S1, S2, S5 and S9 the inconsistent, unsystematic, infrequent or unrestricted association of phenomenological descriptions with REM and Stage 2 as well as the absence of probe differences corroborated failed discrimination performance. All five subjects were state-independent for sleep experience and for experiential qualities. Together these data indicate the subjects' lack of awareness of a REM/2 state difference. These are unlikely to be chance occurrences because of the agreement of multimethod data

for each of these subjects. The likely reason for their failure to identify a state difference is that there was no difference, at least in the terms used to train subjects and those provided by these subjects.

For High recallers S4, S7 and S8 the inconsistent, unsystematic or unrestricted association of phenomenological criteria with REM and Stage 2 corroborated failed discrimination performance. All three subjects were state-independent for sleep experience as well as for experiential qualities. However the fact that subjects S4, S7 and S8 did not articulate 'self/nonself differentiation', 'clarity of sensory experience' and 'recallability of experience', respectively, indicates that they might have been able to use these to guide successful discrimination performance. However this is speculative since noticing the importance of these variables might not ensure their successful use in discriminating sleep states (cf. Nisbett & Wilson, 1977). In addition, the 'permeability or facilitative nature of the sleep-wake boundary' variable likely could not have been used by S8 since it had been created post hoc by the investigator.

Overall then, eight subjects provided evidence that they were state-independent for sleep experience and for experiential qualities. Thus this finding likely explains why they failed to notice a state difference. A noticeable state distinction probably did not exist, at least in the terms illuminated by the present study. These are unlikely

to be chance occurrences because of the agreement of discrimination and phenomenological data for each of these subjects. Finally, having had a recallable experience did not significantly change the overwhelming majority of results reflecting subjects' inability to identify and describe the nature of a state difference. Only isolated instances of experiential qualities were lost as bases for a state difference when only recalls were examined.

Following idiographic analyses subjects were then categorized for success/failure to identify a state difference as well as for type of sleep state organization for sleep experience (Section 3.3.6.). Binomial assessments of the relationships between these two types of classification of subjects then permitted the tests of hypotheses.

Hypotheses 1, 2, 4 and 5 were not confirmed. Low recallers were not more likely than High recallers to identify a state difference (Hypothesis 1). High and Low recallers were not distinguishable in terms of sleep state organization (Hypothesis 2). Moreover, only one Low recaller successfully identified a state difference yet this success was not associated with an awareness of a REM-dependent state organization for sleep experience (Hypothesis 4). Only one High recaller successfully identified a state difference but this success was not associated with an awareness of a state-dependent organization for experiential quality (Hypothesis 5). In fact the only High recaller to identify a state distinction

was REM-dependent for sleep experience. This result both confirmed Hypothesis 3 and replicated the finding from Study #1.

Results from the idiographic perspective have a number of implications. Both Studies #1 and #2 agreed in failing to replicate Antrobus and Antrobus's (1967) findings. It is likely that the former are the more valid results since the latter failed, among other things, to employ important empirical controls. The threats to internal validity which characterized Antrobus and Antrobus's study were experimentally controlled in the present research. Two of these were the time of night and time into stage confounds. In addition a biased distribution of wakeups altered the a priori probability of target stage of awakening.

Therefore these methodological differences probably account for the fact that across Studies #1 and #2 there was no evidence that 2 in 3 subjects can identify a state difference at night. Eighty percent of 15 subjects across two studies failed to identify a state difference over their respective test nights. On the other hand the finding that the only High recallers to identify a state difference were REM-dependent for sleep experience is the most reliable result. It was found in two studies despite different experimental designs. Replications are required, and especially for Low recallers.

In general the findings reported in both studies are congruent with those presented by Gibson et al (1982).

Directing subjects' attentional bases for perceiving and the vocabulary for articulating these perceptions may produce phenomenological descriptions biased towards experimenter-relevant terms. Yet, training clearly failed to ensure the demonstration of an exact state-stage correspondence. A difference must exist for the experimenter's criteria to be useful. Moreover subjects did use other criteria as well (eg. dream-body). This may have been a function of relaxed obligations communicated to subjects by the experimenter during training sessions.

Despite the trends in the data High and Low recallers were not unequivocally distinguishable on the basis of sensitivity to internal states or cognitive style (Appendix D, Table 23). In fact, only High recallers (S4, S7 and S8) failed to notice probe evidence for a possible state distinction when discrimination judgments had failed to identify a REM/2 difference. This may indicate that these High recallers were less attuned to their internal states. On the other hand, Low recaller S3 was aware of the relevance of the probe indexed basis for a state difference. Alternatively, it is conceivable that the motivation of High recallers S4, S7 and S8 had decreased in light of feedback indicating their failure to identify a state difference. One concomitant of diminished efforts might have been a decreased attentiveness to the possible value of question-probe variables in defining a state difference.

Sensitivity to internal states measured by response to

the Private Self-consciousness items and a field-independent, cognitive style may have helped the two subjects who did succeed in identifying a state difference (Table 23). High recaller S10 exhibited the second highest level of sensitivity to internal phenomenology in Study #2. Low recaller S3's responses reflected the highest level of sensitivity of all Low recallers. Thus, sensitivity may have enhanced the perception of an existing state difference.

Likewise, subjects S3 and S10 exhibited two of the three most field-independent cognitive styles of all subjects. Therefore, this aptitude may have enhanced their ability to identify an existing distinction as well. This might have been accomplished by making relatively field-independent subjects who were also relatively more sensitive to internal states more likely to: 1) act in discriminating fashion in the use of phenomenological cues; and 2) develop and modify a successful strategy in response to feedback (cf. Goldstein & Blackman, 1978; Witkin & Goodenough, 1981). On the other hand, High recaller S2 in Study #1 had demonstrated the least field-independent cognitive style because he had adopted a slow and deliberate strategy for performing on the Embedded Figures Test. He did this in spite of the standard instructions to work as quickly as possible. Moreover, High recaller S4 in Study #1 exhibited the most field-independent style and it was this subject whose Training night data suggested the

possibility that he might have been able to identify a state difference at Post-test.

Consequently, sensitivity and cognitive style may be qualities which enable subjects to identify a state difference if one were there. Subjects need to be attuned to internal experience and its qualities to notice that it varies in these terms. Future research might involve selecting subjects on the basis of Frequency of Home Dream recall as well as sensitivity to internal states.

Studies #1 and #2 each failed to replicate the finding that REM/2 state differences are expressed in probe indexed, distributional terms for subjects in general (Foulkes, 1985), for males (eg. Foulkes, 1962), and for High recall males (eg. Moffitt, et al, 1982). Across the two studies a consensus as to the nature of the few, isolated instances of distributional differences was absent. There are a number of methodological differences which can account for these failed replications.

The present research investigated subjects' awareness of a state difference while other research has had subjects respond to probes or provide experience reports which judges then rate using probe dimensions. In each of the latter the key variables could only be framed in the experimenters' theory-relevant terms. Furthermore, the empirical control of frequency of home recall, time of night, time-into-stage and first night threats to internal validity also distinguish the present from earlier research. Studies #1 and #2 also included more extensive

samples of sleep stage trials since awakenings were performed across all REM/NREM cycles (cf. Foulkes, 1962; Moffitt, et al, 1982). This is important since Moffitt et al collected only 4 data points (REM= 2; Stage 2= 2) from each subject, and these arousals were typically done in the middle of the night. This is contrasted with the present data which included 4 REM and 4 Stage 2 awakenings, and distributed throughout the night.

Moreover the present results indicate that when response scales do not force ratings to vary between theory-relevant extremes, distributional differences reported in the literature may not be found. For instance the dreamlike fantasy scale (eg. Brown & Cartwright, 1978) forced responses to vary between endpoints that were defined as 'conceptual' versus 'perceptual' experience. Consequently research which used this scale revealed that REM/NREM state discriminability was defined by a thinking-perceiving difference (cf. Schwartz, et al, 1978). Yet, when these two characteristics were separated the present research failed to find this difference. This suggests that earlier findings may have been artifactual of the use of the dreamlike fantasy scale. The present findings did replicate findings that reflection can occur regularly in association with REM (eg. Purcell, et al, 1986).

However, an additional reason for the failure to find distributional differences is suggested by the discrepant answers to the REM/2 psychophysiology question obtained

from nomothetic and idiographic analyses in each of Studies #1 and #2. For instance, the group analyses in Study #2 indicated that High recallers successfully identified a state difference and were REM-dependent for sleep experience. Meanwhile idiographic assessments showed that this was the case for S10 only. The same finding was reported for S3 whose discrimination success likely swayed Low recaller group results. This was reported for S2 in Study #1 as well. In Study #1 the nomothetic picture had revealed that the experiment succeeded while the idiographic assessments had shown that the experiment had failed.

This divergence between nomothetic and idiographic results raises the possibility that earlier studies' evidence of a REM/2 state difference may have been the result of group analyses. That is, nomothetic analyses may have permitted strong state-stage correspondence data from a small minority of subjects to sway the overall group result. This speculation is reinforced by the fact that evaluations of group data have been the analyses of choice in psychophysiological dream research (e.g., Antrobus, et al, 1978; Schwartz, et al, 1978).

However, the large number of differences between the present and earlier research makes it impossible at present to identify the exact source of their divergent results. Both methodological and data analytic factors may have been operating.

The fact that High recallers were more REM-dependent

for sleep experience than Low recallers in Study #2 also disconfirms Moffitt et al's (1982) findings. However as outlined above there are a sufficient number of methodological differences between the present investigations and Moffitt's research to account for this divergence.

One key finding from both Studies #1 and #2 is that when methods permit, subjects' psychophysiological relations can vary in terms of the exactness and nature of the state-stage correspondence. This reinforces the decision to assess data idiographically. For instance Study #2 has shown that both High and Low recaller groups were composed of different subpopulations of subjects varying on the basis of the exactness of their state organization for sleep experience. These results underline the need in future research to identify base rates reflecting success in identifying a REM/2 state difference as well as for indices of sleep state organization. The replication of Study #1 by Study #2 suggests the existence of High recaller base rates of 20 percent each for success in distinguishing states as well as for a REM-dependent state organization for sleep experience.

Generally speaking, the fact that outlier, state-stage correspondence data from S10 and S3 were isolated makes the idiographic picture more accurate and valid than the nomothetic one. It is for this reason that only the important ramifications associated with the former are

discussed at this time.

For all but subjects S3 and S10 the absence of a significant state-stage correspondence likely indicates that different types of subject-identified experience or even different distributions of experience can not be reliably predicted or explained by variations in patterns of electrophysiological activity. As with Study #1 these results challenge the assumption that phenomenology must differ because physiological sleep stages are readily distinguished. Thus, for these 8 subjects interpretations of these covariation data such as isomorphism, parallelism, identity or reductionism are inappropriate. The phenomenology associated with the two states was largely equivalent.

On the other hand S3 and S10 each provided covariation data suggesting a strong state-stage correspondence. For Low recaller S3 dreaming occurred independently of sleep state yet different intensities of experiential quality were associated with REM and Stage 2. High recaller S10's data indicated that dreaming occurred almost exclusively during REM, and different intensities of experiential quality also differentiated REM and Stage 4. Consequently physiology might be able to account for the occurrence and nature of phenomenology for each of these two subjects. As in Study #1 subjects may therefore vary in terms of whether their covariation data can sustain interpretations such as experience-physiology parallelism, isomorphism, identity, or reductionism. The overall implications of the two studies

will now be discussed.

3.5. Implications of Findings

From the idiographic perspective there was extremely weak evidence for a subject-identified REM/2 state difference. Eighty percent (12/15) of all subjects across the two studies failed to identify a state difference despite the fact that very strong inter-judge data indicated that the two sleep stages were distinguished reliably. Moreover, High and Low recallers were equally likely to fail to identify this state distinction. The likely explanation for this failure is that there was no difference, at least in the terms highlighted by the present research. For these 12 subjects the absence of a state difference was reflected in state-independent organizations for the incidence of sleep experience and sleep experience quality.

Alternatively, sleep state organization appeared to be the best predictor of a subject's likelihood of identifying a significant state-stage correspondence. High recallers S2 and S10 in Studies #1 and #2 respectively were each REM-dependent for incidence of sleep experience. Low recaller S3 in Study #2 was REM-dependent for greater intensities of experiential quality. These indices of sleep state organization reflect these subjects' awareness of a difference which was expressed in these terms.

This means that 4 out of every 5 High or Low recallers in the second study showed the same lack of awareness of a

state distinction. Phenomenological descriptions and discrimination judgments agreed in indexing the absence of a noticeable state difference. Thus, with rare exception High and Low recallers were not distinguishable on the basis of: 1) the ability to identify a REM/2 state difference; 2) the state organization for sleep experience; or 3) the state organization for experiential quality. These are unexpected results (cf. Moffitt, et al, 1982) although an even less anticipated finding from Study #2 was the following.

In spite of the fact that the High and Low recallers were the most extreme groups of subjects studied to date in psychophysiological dream research (cf. Moffitt, et al, 1982; Purcell, et al, 1986) these two types of subject were barely distinguishable on the basis of their respective REM, Stage 2 and total recall rates across Test nights (Appendix D, Table 24). This similarity increases when Low recaller S5 is excluded from this impressionistic evaluation. The reason is that he was unusual even for a Low recaller. Only once over the 24 Test night awakenings did he report having had a sleep experience. His case will be discussed below.

On the other hand the remaining 4 Low recallers became high recallers of sleep experience in the laboratory. In fact Low recaller S3 demonstrated the highest recall rates of all subjects across all trials (95.8%), as well as for each of REM (100%) and Stage 2 (91.7%). Consequently the

large discrepancy between High and Low recallers for home dream recall diminished significantly to the point of almost disappearing in the laboratory. High home recallers' recall rates increased as well, but to a lesser extent. This finding regarding Low recallers has strong implications.

Foulkes's (1978, 1981, 1982, 1985) cognitive-psychological and psycholinguistic models were developed to describe the mechanisms or processes presumed to be responsible for the production of dreams. Therefore from these points of view, differences in frequency of dream recall have been conceived as reflecting differences in rates of production of dreams. However the recall data from Study #2 disconfirm this view. These data suggest a difference at the level of post-production.

There are numerous explanations for failures to recall dreams under experimental or home conditions (cf. Cohen, 1974, 1979; Goodenough, 1978). These include the repression, salience, interference, memory consolidation, and arousal retrieval explanations. The following discussion will focus on some of these accounts where appropriate. On the other hand there are data available from Study #2 which suggest that differences in frequency of recall at home for High and Low recallers may be a function of differences in the rate of information transfer from sleep and to the waking state. Moreover this information points to a process or mechanism that may be responsible for these differences in rates of cross-state transfer.

A working hypothesis will guide the following discussion. It is posited that whatever constitutes the post-production difference between High and Low home recallers may be the process or mechanism which became altered or modified for the Low recallers when they participated in Study #2. Moreover this change may have become manifested as an increase in the frequency of sleep experience recall.

Cohen (1976, 1979) has speculated that the process of awakening might influence the transfer of sleep experience information into wakefulness. Evidence for the view that the quality of awakening can affect the transfer and subsequent recall of sleep experience has been reported by Shapiro, Goodenough, Lewis and Sleser (1965). They found a significant increase in dream recall when subjects were awakened relatively abruptly as opposed to conditions when they were aroused gently. The first type of wakeup call yielded a relatively direct arousal into the waking state and subjects more easily recalled dreams. However the second type of arousal provoked many reports of having forgotten the sleep experience because subjects did not wake up directly into the waking state. This effect was most pronounced for infrequent recallers. However, in order to more fully appreciate what waking up involves a brief description is required. This discussion pertains to non-clinical populations.

Waking up involves crossing through a sleep-wake

boundary or 'warp' (cf. Laughlin, McManus, Rubinstein & Shearer, in press; Laughlin, McManus & Shearer, 1983). Recalling a dream upon awakening requires the transfer of experiential information from sleep and 'through' this boundary to the waking state. Moreover, boundaries joining experiential states can vary along a dimension of lesser to greater degrees of permeability or openness. This indicates that they vary in their ability to regulate the transfer of available information between, for example, the sleeping and waking states (cf. Brent, 1984; Cohen, 1979; Hartmann, 1984, 1986; Mahrer, 1978). Hence, the degree of boundary permeability and the likelihood of successful cross-state information transfer probably covary. By 'information' is meant the recallable contents of an individual's experience within an experiential state. For instance, recallable contents refer to perceptual, behavioral and affective experience as well as the objects of this experience: eg. people, events, self, etc.

The permeability of a boundary may change in response to certain influences such as stress (cf. Hartmann, 1984). However it is probably the case that each individual's sleep-wake boundary exhibits a relatively stable, baseline value of permeability (Cohen, 1979). In this vein Cohen (1979) has suggested that there may be individual differences in the psychobiological 'state boundary' (cf. Cartwright, 1972) joining waking and sleeping. Consequently it could be assumed that there may also be concomitant individual differences in the transfer of experiential

information into the waking state.

As a result this description raises the possibility that High and Low home recallers differ on the basis of the permeability or openness of their respective sleep-wake boundaries. Moreover it is possible that this difference accounts for the difference in their rates of home dream recall. However, while it might be appealing to infer the existence and permeability quality of a state boundary on the basis of an individual's number of successful dream recalls (ie. transfer implied), a more direct measure might be useful. The question of how to observe and quantify such an interstate boundary is addressed at this time.

Cohen (1979) has speculated that it is the electrophysiological similarity or congruence of the sleeping and waking states which may define a state boundary regulating the transfer of available sleep experience. Furthermore Goldstein, Stoltzfus and Gardocki (1972) have suggested that state boundaries might be measured by observing the relationship between states on the basis of the degree to which they share the same EEG amplitude and/or frequency characteristics. From this point of view there is recent empirical evidence which provides tentative support for the view that High recallers show a more permeable sleep-wake boundary than do Low recallers.

For instance, High recallers' electrophysiological activity has demonstrated a greater continuity or integrity of rhythmic cortical processes in the transition from

sleep to waking than has Low 'recallers' bioelectrical activity (Armitage, 1986). Thus the organization of these states with reference to one another differs for High and Low recallers. The dependent measures in this research amounted to electrophysiological activity within particular EEG frequency bands assessed pre- and post-awakening. The data were analyzed using summative, digital period analytic techniques.

This finding is corroborated by Moffitt and Hoffmann's (1987, in press) data indicating that High 'recallers' electrophysiological brain activity pre- and post-awakening demonstrated a greater interstate dependence than did Low recallers. Interstate dependence was indexed by a more complex pattern of correlations between EEG frequency activity pre- and post-arousal. These data suggest a greater degree of continuity of states for High recallers, and as evidenced by the temporal extension of pre-wakeup electrophysiological activity into the post-awakening period.

These data are suggestive. One implication of these results is that the EEG-defined congruence of adjoining states is at worst an electrophysiological concomitant and at best an operational definition of the permeability of their interstate boundary. That is, the greater the EEG congruence of adjoining states, the more permeable the interstate boundary (cf. Koukkou & Lehmann, 1980, 1983; Lehmann & Koukkou, 1984). Consequently it may be the case that the more permeable the interstate boundary, then the

greater the likelihood of transferring and recalling available experiential information after crossing between these states. Therefore it is speculated that frequency of dream recall may covary with the permeability of the sleep-wake boundary defined electrophysiologically. There are additional data which support this idea.

For instance, the following sleep types decrease both in terms of their respective frequencies of successful dream recall and their EEG-defined congruence (ie. boundary permeability) with the waking state: REM > Stage 2 > Stages 3/4 (eg. Foulkes, 1962; Moffitt, et al, 1982; Pivik & Foulkes, 1968). Moreover the following subject-by-sleep state combinations decrease both in terms of their respective frequencies of dream recall and their EEG-defined congruence with waking (cf. Koukkou & Lehmann, 1980, 1983; Lehmann & Koukkou, 1984). That is, these results could be predicted by 'multiplying' the recaller type and sleep stage effects either for recall frequency or for their EEG-defined congruence with waking: High recallers' REM > Low recallers' REM > High recallers' Stage 2 > Low recallers' Stage 2 (Moffitt, et al, 1982).

Consequently these data appear to support the view that the EEG-defined congruence (ie. boundary permeability) of adjoining brain states A and B at least covaries with, if not determines the probability of transferring and recalling experience from State A following entry into State B. The probability or frequency of dream recall

appears to covary with the permeability of the sleep-wake boundary defined electrophysiologically. Moreover, there is further evidence to support the contention that High recallers' sleep-wake boundary is more permeable than that of Low recallers.

Field-dependent, infrequent dream recallers have manifested what could be considered the phenomenological effects of a relatively less permeable sleep-wake boundary. These subjects have been found to provide 'contentless' experience reports more frequently when awakened in the laboratory than have field-independent, frequent dream recallers (cf. Cohen, 1972, 1979; Goodenough, 1967; Goodenough, et al, 1974, 1975). That is, Low recallers have been more likely to report having forgotten or 'lost' a pre-awakening experience in the process of waking up. One interpretation is that relative to High recallers, Low recallers' less permeable sleep-wake boundary makes it difficult or impossible to transfer this experiential information into the waking state.

In addition, Moffitt et al (1982) have reported that Stage 2 awakenings for Low recallers have provided the highest incidence of contentless reports. This is not surprising since each of Stage 2 (vs. REM) and Low (vs. High) recallers exhibit a less permeable sleep-wake boundary indexed by a poorer EEG-defined congruence with the waking state than its counterpart.

It has also been found that relative to Low recallers, High recallers have tended to manifest the effects of a

more permeable wake-sleep boundary. Research has shown that field-dependent, Low recallers were less likely to have their dreams affected by stressful presleep experience than were field-independent, High recallers (cf. Goodenough, et al, 1974, 1975). That is, the former were less likely to have strong affect produced by presleep, stressor films (eg. ritual circumcision) incorporated into dream reports obtained following experimental awakening. Moreover Low recallers' recall incidence decreased on 'stressor' nights relative to their control nights. On the other hand, anxiety more often characterized the dreams of the frequent recallers, and their recall incidence did not vary significantly across experimental and control nights. These data have often been used to support a repression hypothesis (Cohen, 1974, 1979).

However these particular data do not actually permit an unequivocal 'boundary' interpretation. That is, the witnessed effects of the experimental manipulation might have been a function of a less permeable wake-sleep boundary precluding access to sleep experience or a less permeable sleep-wake boundary inhibiting the recall of dreams characterized by heightened anxiety. Either way the role of interstate boundaries is implied, and on this basis High and Low recallers are distinguishable.

An impressionistic evaluation of the data from Study #2 (Appendix D, Table 24) presents evidence to substantiate a boundary explanation of differences between High and Low

recallers. Despite having had virtually as many sleep experiences as High recallers, the Low recallers nevertheless appeared to have greater difficulty transferring this experiential information to the waking state in order to recall it. An assessment of the contentless category of the post hoc, permeability of sleep-wake boundary variable revealed the following.

Low recallers as a group had more contentless events occur in association with each of the two sleep states as well as overall than did High recallers. That is, in each case Low recallers more often reported that they had had a sleep experience yet they could definitely not recall it. The clearest difference between recaller groups was for REM awakenings. These data confirm Goodenough's (1967) findings regarding this difference between frequent and infrequent recallers. Moreover, the following types of awakening decreased in terms of frequency of contentless reports: Low recallers' REM = Low recallers' Stage 2 > High recallers' Stage 2 > High recallers' REM. These results are for the most part what would be expected on the basis of these subject-by-sleep stage combinations' respective values of EEG-defined congruence with the waking state.

On the other hand, an evaluation of the 'moderately facilitative' category exhibited that overall as well as for REM and Stage 2, High recallers more often provided evidence that they had had sleep experience which they could recall albeit with some difficulty. The clearest difference between High and Low recallers was for REM

awakenings. Finally, an assessment of the 'very facilitative' category revealed that overall and for REM, High recallers more often expressed that they had had sleep experience which they could recall easily.

There is additional evidence to support the view that frequency of dream recall and sleep-wake boundary permeability covary as well. It has been shown that one way to increase one's frequency of recall is to directly alter the boundary between these two states. The presumed effect of this manipulation is the increased permeability of the sleep-wake boundary.

That is, when individuals have repeatedly practiced the conscious maintenance of their attention and awareness to particular contents in the hypnagogic transition from the waking to the sleep state, their frequency of recall of sleep experience has been found to increase (cf. Chang, 1974; Corriere & Hart, 1977; Evans-Wentz, 1958; Faraday, 1972; Garfield, 1973; Krippner & Hughes, 1970; Reed, 1973, 1976; Shearer, 1977). In fact Laughlin, McManus, Rubinstein and Shearer (in press) have reported anecdotal evidence that one additional consequence of this practise is the development of an experientially defined, smoother transition from the waking to sleeping state. Moreover, empirical evidence has shown that the natural state of affairs for High recallers appears to involve spending a significantly longer period of time in the hypnagogic period than do Low recallers (cf. Foulkes, et al, 1966;

Wells, et al, 1978).

There are additional practices which have also been found to increase individuals' frequency of dream recall. For instance, experimental and anecdotal evidence has shown that getting subjects to pay attention to, record or use dreams on a daily basis can increase their rate of dream recall (eg. Corriere & Hart, 1977; Faraday, 1972; Garfield, 1973, 1974; Krippner & Hughes, 1970; Purcell, 1987; Purcell, et al, 1986; Reed, 1973, 1976). One possible explanation of these results is that by heightening subjects' attention and awareness to the sleep-world and its products the permeability of the sleep-wake boundary may increase. This intervention may affect the sleep-wake boundary which in turn promotes an increase in frequency of recall.

However it has also been argued that this attention-focussing technique has an additional effect: an increase in the positiveness of the attitude toward dreaming (Reed, 1973; Shearer, 1977). Therefore it is not surprising that research has found that frequency of recall covaries with: 1) amount of attention paid to dreaming; 2) amount of time spent using dreams; 3) positiveness of attitudes toward dreaming; 4) belief in the meaningfulness of dreams; 5) the tendency to introspect in general; 6) the acceptance, openness and anticipation of dreaming; and 7) the belief that dreams can provide information useful for waking life (cf. Cohen, 1979; Foulkes, et al, 1966; Hiew, 1976, cited in Domhoff, 1985; Purcell, 1987; Schonbar, 1965; Strauch,

1969; Wallach, 1963). That is, individuals who exhibit higher rates of dream recall tend to hold a positive attitude toward dreaming as well as pay considerable attention to sleep experience.

These results suggest that whether attention is focussed on dreams during the waking state or on experiences in the transition between these two states, the manifest effect appears to be the same: an increase in recall frequency. However it is conceivable that other indicators of this change could be observed as well. If frequency of recall and sleep-wake boundary permeability covary, then attention-based interventions designed to change frequency of recall should also produce changes in sleep-wake boundary permeability. An empirical investigation of this relationship will be proposed in a moment. In the mean time these descriptions may help illuminate why 4 Low recallers' recall rates increased so drastically while in Study #2.

For the sake of argument it is assumed that the Low recallers entered the study having a less permeable sleep-wake boundary than did the High recallers. Moreover this boundary could have been observed electrophysiologically, (eg. interstate dependence) and phenomenologically (eg. contentless reports). However, once accepted into the study their attention and anticipations likely became focussed on the possibility of encountering sleep experiences. This is a relatively unusual event for Low recallers and the

thought of recalling dreams may have elicited some concern as to whether they could perform adequately. However, encouragement from the experimenter may have relaxed these subjects to some degree.

Nevertheless this increased attention to dreaming could have promoted an increased recall frequency in and of itself. However the experimental intervention involved much more. That is, eight times per night the experimenter created a sleep-wake boundary by awakening the subject. That is, eight times the subject was forced to exit sleep through this boundary (ie. transformation of EEG) and then he was encouraged by task demands to deploy and focus attention on possible pre-wakeup experience. However, many subjects reported having focussed their attention on possible memories of sleep experience while waking up.

That is, many subjects described that early in the study they had recognized the value of deploying attention while awakening. By doing this they could then more easily and readily detect dream information that could be used to make discriminations of sleep state and to inform phenomenological descriptions. Moreover the wakeup call and instructions to remain still were designed to promote the focussing of attention on pre-wakeup information so that distractions from the external laboratory environment would be minimized. This practice has been found to affect rates of dream recall as well.

For instance it has been shown that conditions which decrease possible interference following experimental

awakening increase the likelihood of successful recalls of sleep experience as well as decrease the probability of obtaining contentless reports in the sleep laboratory (cf. Cohen & Wolfe, 1973). As a result the inclusion of a technique to ~~preclude~~ distraction in Study #2 likely increases the feasibility of a boundary permeability interpretation for contentless reports.

Consequently the practice of directing subjects' attention eight times per night toward the sleep state may have effected a change in the sleep-wake boundary. That is, as with the techniques aimed at maintaining attention while falling asleep, the experimental protocol may have promoted a similar albeit less developed aptitude for using or maintaining attention while awakening. As a result the permeability of the sleep-wake boundary may have increased, thereby increasing the likelihood of transferring and recalling existing sleep experience. In short, all of these facets of the experimental situation likely interacted to produce an easier access to, and cross-state transfer of, sleep experience. What is common to these techniques is that they facilitated subjects' deployment of attention toward sleep experience.

However it must be stressed that these hypothesized changes in the permeability of the sleep-wake boundary and frequency of recall might not be long lasting because of the limited, transient nature of the experimental intervention. It is unlikely that a history of infrequent

dream recall and a relatively less permeable sleep-wake boundary could be changed significantly over the course of four nights. Phenomenological and electrophysiological data to support this assertion are available.

Low recallers' phenomenological data in Study #2 showed what could be considered the effects of an inertia or resistance to change possibly rooted in a history of low rates of cross-state transfer of dreams. Even with a strong increase in the frequency with which sleep experiences could be recalled in the laboratory, Low recallers' responses reflected that they continued to experience more difficulty recalling their sleep experiences than did High recallers (Appendix D, Table 24). This difference is a distributional one. In support of this inertia conception Purcell (1987) recently found the following. Even when Low recallers' attention was focussed on dreams in a 3 week dream diary study and their rates of recall increased over initial home levels, these subjects remained less open than High recallers to the possibility that their dreams could benefit their waking life.

Moffitt and Hoffmann (1987, in press) have also reported evidence reflecting a similar inertia demonstrated by Low recallers' electrophysiologically indexed, sleep-wake boundary. They reported that High recallers' degree of electrophysiologically defined, interstate dependence exceeded the degree of interstate dependence (ie. boundary permeability) displayed by Low recallers even when the only EEG data subjected to analysis were associated with

successful recalls of sleep experience. That is, under the same conditions of having recallable sleep experience Low recallers' sleep-wake boundary remained less permeable than that of High recallers.

Therefore, one implication associated with all of these findings is that techniques designed to increase frequency of recall hold promise but likely only if they are integrated within daily practice (cf. Laughlin, et al, 1983; Laughlin, et al, in press; Shearer, 1977). Moreover, High recallers' recall rate in Study #2 may have changed to a lesser degree for the following reason. With a relatively more permeable sleep-wake boundary their home recall rates may already more closely approach their ceiling level than does Low recallers' home rate.

One alternate interpretation of these findings is that the attention based manipulations just described actually increase the frequency with which sleep experience occurs rather than increasing access to it by changing boundary permeability. However, there is no independent means by which either position could be assessed unless subjects could be trained to provide signalling behavior (eg. presence vs. absence of dreaming) to corroborate discriminations of sleep state. In dream research the experimenters' window on sleep experience is the subject's reports (Cohen, 1979).

In assessing Low recaller S5's single report of a sleep experience and his lack of 'contentless' events

(Appendix D, Table 24), one interpretation might be that there was a lack of experience on 23 of 24 trials. However the available evidence regarding Low recallers' sleep-wake boundary suggests a more likely explanation. S5's sleep-wake boundary was so impermeable that he did not have even the slightest recollection of a pre-wakeup experience. In either case these data indicate that S5 was clearly different from the other 14 subjects across the two studies. More research is required to clarify cases such as S5.

Following this discussion a research endeavour could be developed. It would evaluate the effects that interventions designed to increase the frequency of dream recall have on sleep-wake and wake-sleep boundary permeability. One dependent measure might be the discrepancy of the home and laboratory recall rates used as an index of the permeability of the sleep-wake boundary. That is, the more the laboratory rate exceeds the home rate, the less permeable the home sleep-wake boundary. The former would be assessed over baseline nights. Other measures pertaining to or associated with the 'boundary' construct could include: 1) the congruence of pre- and post-awakening EEG (cf. Moffitt & Hoffmann, 1987, in press); 2) the EEG congruence of Stage 1 and Stage 2 (ie. wake-sleep boundary); 3) phenomenological indices of the permeability of the sleep-wake boundary (ie. contentless reports); 4) phenomenological indices regarding the nature (eg. smooth vs. abrupt; fast vs. slow) of the transitions

through the hypnagogic and hypnapompic periods; and 5) questions assessing the positiveness of attitudes toward sleep experience.

Subjects could sleep in the laboratory for 4 baseline nights with the experimental protocol, data collection techniques and variables being the same as those used in Study #2. Subjects would be trained to distinguish REM and Stage 2. Then, after the fourth night each subject would be assigned a strategy designed to increase recall (eg. record dreams; maintain attention to contents while falling asleep). Subjects would employ this technique for a month and their home recall rates would be assessed in the week preceding their return to the laboratory to sleep four post-test nights. Once in the laboratory the same wakeup protocol, data collection techniques and variables used on Baseline nights would be employed.

The questions investigated would be whether the frequency of recall changes as a function of the intervention, whether a simultaneous increase in boundary permeability would be seen, and, whether the latter could account for the expected increment in recall. Following the results in Study #2 it would also be expected that Low recaller subjects' recall rate and the permeability of their sleep-wake and wake-sleep boundaries would exhibit the greatest increases. Moreover, if frequency of dream recall and boundary permeability do covary then each subject's home-laboratory recall rate difference should

decrease as a function of the intervention. Other changes might include the following. The transition into and out of sleep might become smoother, longer and easier. This might be seen electrophysiologically (cf. Moffitt & Hoffmann, 1987, in press) as well as experientially (cf. Laughlin, et al, in press). Information such as daytime affect may become more easily transferred into sleep and more readily incorporated into sleep experience. Sleep experience might increase in its influence on waking experience. Finally, attitudes toward sleep experience might become more positive. However, all interpretations of data would have to take the following into account. Sleeping in the laboratory and being awakened eight times per night might also have an effect on increasing dream recall rates.

Therefore, the preceding discussion has provided speculation that the most important difference between High and Low recallers might involve the quality of the boundaries connecting their waking and sleeping states. The contention is that possibly, and with rare exception (eg. S5), Low recallers do not recall often at home because their relatively less permeable sleep-wake boundary likely prevents the transfer of sleep experience into wakefulness. Being in the laboratory may have increased the permeability of the sleep-wake boundary, however. Therefore the thing which most likely distinguishes High and Low recallers-- the degree of sleep-wake boundary permeability-- may have been what was modified by the attention manipulating practices in Study #2.

One major implication of the data from Study #2 and this argument is that Low recallers only appear to be dependent on the occurrence of the waking (vs. sleeping) state for a high incidence of recallable experience relative to High recallers. Therefore they only appear to be constrained by physiological state for the availability of experience when compared to High recallers. The data from Study #2 suggest that the reason they present this picture is that their relatively less permeable sleep-wake boundary precludes the transfer of information across these states.

Consequently the available electrophysiological and phenomenological, laboratory data suggest the following. Low recallers may be constrained more by the functioning of their sleep-wake and wake-sleep boundaries than by their sleep states' ability to produce sleep experience. In light of this finding a potentially interesting research project might be to evaluate how sleep-wake and wake-sleep boundary parameters are set during ontogeny. Individual (eg. circadian rhythms), familial, and socio-cultural influences likely interact in shaping their development. The data and theory described above suggest that the issue of attention and skills related to its deployment may be the key factors in such a research investigation, (cf. Strauch, 1969). At this time a final summary is presented.

3.6. Summary

Ever since REM sleep was 're-discovered' in the 1950's

(cf. Aserinsky & Kleitman, 1953; Ladd, 1892; Max, 1935) and it was reported that there was a psychophysiological parallelism between REM sleep and dreaming, our view of dreaming and in fact brain process in general was bolstered by such a parsimonious occurrence (Cavallero & Cicogna, 1984; Foulkes, 1978, 1981, 1985; Stoyva & Kamiya, 1968). In fact, many researchers became attracted to the psychophysiological study of dreams because a hope had been kindled by these findings.

That is, it was anticipated that "the delineation of electrophysiological correlates of the qualitative and quantitative characteristics of dreams and dreaming would lead to an early and expeditious resolution of the mind-body problem" (Moffitt & Hoffmann, 1987, in press, p. 144; cf. Arkin, 1978; Cavallero & Cicogna, 1984). As a result REM sleep came to be known to the public as 'dream' sleep and often it was said that everyone dreams at night (cf. Okuma, Fukuma & Hata, 1970) when in reality what was meant was that everyone had REM sleep at night (Foulkes, 1978, 1981).

Current research however has cast doubt on this conceptualization of brain function regarding the process of dreaming. The first major results along these lines were those of Foulkes (1962) who found that dreams could in fact be recalled from Stage 2 sleep. Subsequent research has shown that dreams can be recalled from all stages of sleep, including Stage 4 (eg. Moffitt, et al, 1982; Purcell, et

al, 1986). Moreover it has been reported that dreaming can occur in the presence or absence of all phasic events, including rapid eye movements (cf. Pivik, 1978).

As a consequence the hope of specifying reductionist or isomorphic mind-brain relations was severely dampened. However, despite the fact that these results denied the concept of the identity of REM sleep with dreaming, very few researchers addressed the question of the relationship of subjects' awareness of variations in experience with different stages of sleep (cf. Arkin, et al, 1978). Only Antrobus and Antrobus (1967) performed such a study with reference to REM and Stage 2, and their study was problematic and limited for the reasons described earlier. Nevertheless their results indicated that there was a parallelism for sleep stage in 2 of 3 cases.

The present research improved upon and extended Antrobus and Antrobus's study of subjects' awareness of a possible REM/2 state difference. It was then reported that the results of Studies #1 and #2 also cast doubt on the assumption of psychophysiological parallelism. For all subjects the different stages of sleep were readily identifiable on the basis of physiological parameters, and following the standard operational definitions for these stages currently accepted by the sleep research community (cf. Rechtschaffen & Kales, 1968). However, variations in the experiential reports of subjects did not map clearly onto these categories of sleep. For only 3 of 15 subjects across two studies could parallelism be considered a

tenable assumption.

Specifically, data from Study #1 disconfirmed the hypothesis that sensitivity to internal states is a condition sufficient to enhance training in promoting the identification of a REM/2 state difference. Then, following the modification of theory to take two types of sleep state organization into account (ie. for recallable experience or experiential quality), Study #2 did not obtain support for its major hypotheses. Low recallers were not REM-dependent for the occurrence of sleep experience, and these subjects were not more likely than High recallers to identify a REM/2 state difference. Both studies failed to replicate Antrobus and Antrobus's (1967) findings but this divergence was readily attributed to strong methodological differences.

What the present data mean is that if there is a psychophysiological parallelism, the physiological parameters of this relationship have yet to be identified and they are not captured by the parameters used to identify sleep stage (cf. Moffitt & Hoffmann, 1987, in press). The large physiological variations observed in the evaluation of sleep stage do not appear to be the ones related to the experience of the subject. Rather they must be taken as indicating changes in brain activity not directly related to phenomenological events.

On the other hand while this description applies to 80 percent of the subjects studied in the present research,

three subjects were identified whose state-stage correspondence data indicated that changes in brain activity may have been closely related to phenomenological events. In fact for 2 of the 3 subjects the best correlate of dreaming appeared to be the global stage called REM sleep. This result reinforces the decision to assess subjects individually. However, Study #2 also produced one highly unexpected result.

It was found that High and Low recallers were barely distinguishable on the basis of rates of laboratory recall of sleep experience. An argument was then developed suggesting that the difference between these recaller groups' home recall rates might reflect a post-production difference involved with information transfer across the sleeping and waking states.

Electrophysiological and phenomenological data were enlisted to inform this view. In fact it was suggested that variations in the permeability of sleep-wake boundary functioning might account for variations in frequency of home dream recall. Consequently, within the context of available data and theory this paper began to clarify the nature of possible differences between High and Low dream recallers. However more research is needed before anything definitive may be said about the relationship of frequency of recall and sleep-wake boundary permeability.

Overall then, the value of the present individual difference approach to psychophysiological dream research might be characterized as follows. While this strategy was

designed to preserve differences between subjects perhaps its strongest contribution was that in Study #2 it helped identify the nature of similarities across subjects varying on the basis of extremely discordant rates of home dream recall. This result was then responsible for promoting the development of a boundary interpretation of the differences between High and Low frequency recallers.

As a result it is recommended that more research be undertaken to further clarify what it means to be a High or a Low frequency recaller. Accordingly the relationship between frequency of recall and sleep-wake boundary functioning might constitute an appropriate focus for future study. In this regard the individual difference strategy employed in the present research might prove useful.

References

- Adams-Webber, J.R. & Mancuso, J.C. (Eds.) Applications of Personal Construct Theory. 1983. Toronto: Academic Press.
- Agnew, H.W., Webb, W.B. & Williams, R.L. (1966). The first night effect: an EEG study of sleep. Psychophysiology, 2, 263-266.
- Antrobus, J.S. (1983). REM and NREM sleep reports: comparison of word frequencies by cognitive classes. Psychophysiology, 20, 562-568.
- Antrobus, J.S. & Antrobus, J.S. (1967). Discrimination of two sleep stages by human subjects. Psychophysiology, 4, 48-55.
- Antrobus, J.S., Antrobus, J.S. & Fisher, C. (1965). Discrimination of dreaming and nondreaming sleep. Archives of General Psychiatry, 12, 395-401.
- Antrobus, J.S., Fein, G., Jordan, L., Ellman, S.J., & Arkin, A.M. (1978). Measurement and design in research on sleep reports. In A.M. Arkin et al (Eds.). The Mind in Sleep: psychology and psychophysiology. New Jersey: Lawrence Erlbaum Associates.
- Antrobus, J.S., Pass, D., Luck, D., Sanders, K., Ellman, S. & Arkin, A.M. (1974). Discrimination of REM/NREM reports. Sleep Research, 3, 102.
- Antrobus, J.S., Rich, K., Nelson, W.T. & Sanders, K. (1973). Multiple linear regression of mentation reports on REM/NREM sleep. Sleep Research, 2, 104.
- Antrobus, J.S. & Saul, H.N. (1980). Sleep Onset: subjective, behavioral and electroencephalographic comparisons. Waking and Sleeping, 4, 259-270.
- Arkin, A.M. (1978). Contemporary sleep research and clinical practice. In A.M. Arkin et al (Eds.). The Mind in Sleep: psychology and psychophysiology. New Jersey: Lawrence Erlbaum Associates.
- Arkin, A.M. & Antrobus, J.S. (1970). Sleep mentation as affected by REMP deprivation. Report to NIMH, MH13866-03.
- Arkin, A.M., Antrobus, J.S. & Ellman, J.S. (1978). The Mind in Sleep: psychology and psychophysiology. New Jersey: Lawrence Erlbaum Associates.
- Armitage, R. (1980). Changes in dream content as a function of time of night, stage of awakening, and frequency of

recall in the subject population. Unpublished M.A. thesis, Department of Psychology, Carleton University, Ottawa, Ontario.

Armitage, R. (1986). Ultradian rhythms in EEG and performance: an assessment of individual differences in the basic rest-activity cycle. Unpublished doctoral dissertation, Carleton University, Ottawa.

Aserinsky, E. & Kleitman, N. (1953). Regularly occurring periods of eye motility and concomitant phenomena during sleep. Science, 118, 274-284.

Austin, M.D. (1971). Dream recall and the basis of intellectual ability. Nature, 231, 59-60.

Bannister, D. & Bott, M. (1973). Evaluating the person. In P. Kline (Ed.). New Approaches in Psychological Measurement. New York: Wiley.

Barber, T.X. (1976). Pitfalls in Human Research. Toronto: Pergamon Press.

Barber, T.X., Walker, R.C. & Hahn, K.W. (1973). Effects of hypnotic induction and suggestions on nocturnal dreaming and thinking. Journal of Abnormal Psychology, 82, 414-427.

Battig, W.F. (1979). Are the "individual differences" between or within individuals? Journal of Research in Personality, 13, 546-558.

Belicki, K. & Bowers, P. (1982). Role of demand characteristics and hypnotic ability in dream change following a presleep instruction. Journal of Abnormal Psychology, 91, 6, 426-432.

Bone, R.N. & Corlett, F. (1968). Brief reports: frequency of dream recall, creativity, and a control for anxiety. Psychological Reports, 22, 1355-1356.

Boring, E. (1953). A history of introspection. Psychological Bulletin, 50, 169-189.

Boss, M. (1977a). I dreamt last night.1: a new approach to the revelations of dreaming--and its uses in psychotherapy. New York: Gardner Press.

Boss, M. (1977b). Dreaming and the dreamed in the daseinsanalytical way of seeing. In C.E. Scott (Ed.). On Dreaming: an encounter with Medard Boss. California: Scholars press.

Brandt, L.W. (1982). Psychologists Caught. Toronto: University of Toronto Press.

- Brent, S.B. (1984). Psychological and Social Structures. Hillsdale, New Jersey: Lawrence Erlbaum Associates.
- Browman, C.P. & Cartwright, R.D. (1980). The first night effect on sleep and dreams. Biological Psychiatry, 15, 5, 809-812.
- Brown, J.N. & Cartwright, R.D. (1978). Locating NREM dreaming through instrumental responses. Psychophysiology, 15, 1, 35-39.
- Buchsbaum, M.S., Mendelson, W.B., Duncan, W.C., Coppola, R., Kelsoe, J. & Gillin, J.C. (1982). Topographic cortical mapping of EEG sleep stages during daytime naps of normal subjects. Sleep, 5, 3, 248-255.
- Campbell, D.T. (1986). Science's social system of validity-enhancing collective belief change and the problems of the social sciences. In D. W. Fiske & R.A. Shweder (Eds.). Metatheory in Social Science. Chicago: University of Chicago Press, pp. 61-82.
- Campbell, D.T. & Fiske, D.W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. Psychological Bulletin, 56, 82-105.
- Campbell, D.T. & Stanley, J.C. (1963). Experimental and Quasi-experimental Designs for Research. Chicago: Rand-McNally Co.
- Campbell, S.S. & Webb, W.B. (1981). The perception of wakefulness within sleep. Sleep, 4, 177-183.
- Carman, G.J., Mealey, L., Thompson, S.T. & Thompson, M.A. (1984). Patterns in the distribution of REM sleep in normal human sleep. Sleep, 7, 4, 347-355.
- Cartwright, R.D. (1972). Sleep fantasy in normal and schizophrenic persons. Journal of Abnormal Psychology, 80, 275-279.
- Cartwright, R.D. (1975). Is REM 4 really dreamier than REM 1? In M.C. Chase, W.C. Stern & P.L. Walter (Eds.) Sleep Research, Vol. 4. Los Angeles: Brain Information Service, p. 181.
- Cavallero, C. & Cicogna, P. (1984). Models and strategies of sleep mentation research. In M. Bosinelli & P. Cicogna (Eds.). Psychology of Dreaming. Bologna: Clueb.
- Chang, C.C. (1974). Teachings of Tibetan Yoga. Sicausus, New York: The Citadel Press.

- Coates, T.J., Killen, J.D., Silverman, S., George, J., Marchini, E., Hamilton, S. & Thoresen, C.E. (1983). Cognitive activity, sleep disturbance, and stage specific differences between recorded and reported sleep. Psychophysiology, 20, 3, 243-250.
- Cohen, D.B. (1972). Failure to recall dream content: contentless vs. dreamless reports. Perceptual and Motor Skills, 34, 1000-1002.
- Cohen, D.B. (1974). Toward a theory of dream recall. Psychological Bulletin, 81, 138-154.
- Cohen, D.B. (1976). Dreaming: experimental investigation of representational and adaptive properties. In G.E. Schwartz & D. Shapiro (Eds.). Consciousness and Self-Regulation: Advances in Research, Vol. 1. New York: Plenum.
- Cohen, D.B. (1979). Sleep and Dreaming. Origins, nature and functions. Toronto: Pergamon Press.
- Cohen, D.B. & Wolfe, G. (1973). Dream recall and repression: evidence for an alternative hypothesis. Journal of Consulting and Clinical Psychology, 41, 349-355.
- Corriere, R. & Hart, J. (1977). The Dream Makers. New York: Funk and Wagnalls.
- Crick, F. & Mitchison, G. (1983). The function of dream sleep. ature, 304, 14, 111-114.
- Cronbach, L.J. (1975). Beyond the two disciplines of scientific psychology. American Psychologist, 116-127.
- Cuddy, M. (1985). An investigation of the continuity hypothesis: indices of structure, descriptive elaboration and organization from mentation reports across states. Unpublished M.A. Thesis, Carleton University, Ottawa.
- Czaya, J., Kramer, M., & Roth, T. (1973). Changes in dream content as a function of time in REM. Paper presented at the Meeting of APSS, San Diego.
- Davis, J.K. & Frank, B.M. (1979). Learning and memory of field independent-dependent individuals. Journal of Research in Personality, 13, 469-479.
- Dement, W.C. & Wolpert, E.A. (1958). The relation of eye movements, body motility, and external stimuli to dream content. Journal of Experimental Psychology, 55, 543-553.
- Domhoff, B. & Kamiya, J. (1964). Problems in dream content study with objective indicators: I. A comparison of home and lab dream reports. Archives of General Psychiatry, 11, 519-524.

- Eagle, E.J. (1974). An exploratory study of the relationships between cognitive and perceptual styles and drives and defenses in differing states of awareness. An unpublished study cited by Witkin, H.A., Dyk, R., Faterson, H.F., Goodenough, D.R. & Karp, S.A. (1974). Psychological Differentiation. New York: Wiley.
- Ericsson, K.A. & Simon, H.A. (1980). Verbal reports as data. Psychological Review, 87, 215-251.
- Ericsson, K.A. & Simon, H.A. (1984). Protocol Analysis: verbal reports as data. Cambridge: MIT Press.
- Evans, C. (1984). Landscapes of the Night: how and why we dream. New York: Viking Press.
- Evans-Wentz, W.Y. (1958) Tibetan Dream Yoga and Secret Doctrines New York: Oxford University Press.
- Faraday, A. (1972). Dream Power. New York: Berkley.
- Feigl, H. (1958). The mental and the physical. In H. Feigl, M. Scriven & G. Maxwell (Eds.). Minnesota Studies in the Philosophy of Science, Vol. II. Concepts, Theories and the Mind-Body Problem. Minneapolis: University of Minnesota Press.
- Feinberg, I. (1974). Changes in sleep cycle patterns with age. Journal of Psychiatric Research, 10, 283-306.
- Feinberg, I. & Lloyd, T.C. (1979). Systematic trends across the night in human sleep cycles. Psychophysiology, 16, 3, 283-291.
- Fenigstein, A., Scheier, M.F. & Buss, A. (1975). Public and private self-consciousness: assessment and theory. Journal of Consulting and Clinical Psychology, 43, 522-527.
- Fisher, C. (1978). Experimental and clinical approaches to the mind-body problem through recent research in sleep and dreaming. In N. Rosenzweig & H. Griscom (Eds.). Psychopharmacology and Psychotherapy: synthesis or antithesis? New York: Human Sciences Press.
- Fiske, D.W. & Maddi, S.R. (1961). Functions of Varied Experience. Homewood, Illinois: Dorsey Press.
- Fiss, H. (1979). Current dream research: a psychobiological perspective. In B. Wolman (Ed.). Handbook of Dreams. New York: van Nostrand Reinhold Co., pp. 20-75.
- Fiss, H. (1983). Toward a clinically relevant experimental psychology of dreaming. Hillside Journal of Clinical

Psychiatry, 5, 2, 147-159.

- Fiss, H. (1984). Toward a clinically relevant experimental psychology of dreaming. Association for the Study of Dreams Newsletter, 1, 1, 1-2, 10.
- Fiss, H. (1986). Experimental strategies for the study of the function of dreaming. Paper presented to the Third International Conference of the Association for the Study of Dreams, Carleton University, Ottawa.
- Fiss, H., Klein, G.S. & Bokert, E. (1966). Waking fantasies following interruption of two types of sleep. Archives of General Psychiatry, 14, 543-551.
- Fleiss, J.L. (1981). Statistical Methods for Rates and Proportions. Second edition. Toronto: J. Wiley & Sons.
- Ford, D.H. (1984). Reexamining guiding assumptions: theoretical and methodological implications. Journal of Counseling Psychology, 31, 4, 461-466.
- Foulkes, D. (1962). Dream reports from different stages of sleep. Journal of Abnormal and Social Psychology, 65, 14-25.
- Foulkes, D. (1964). Theories of dream formation and recent studies of sleep consciousness. Psychological Bulletin, 62, 236-247.
- Foulkes, D. (1966). The Psychology of Sleep. New York: C. Scribner.
- Foulkes, D. (1967). Nonrapid eye movement mentation. Experimental Neurology, 19, 4, 28-38.
- Foulkes, D. (1970). Personality and dreams. International Psychiatry Clinics, 7, 147-153.
- Foulkes, D. (1978). A Grammar of Dreams. New York: Basic Books.
- Foulkes, D. (1981). Dreams and dream research. In Sleep 1980. Fifth European Congress on Sleep Research, Amsterdam. Karger, Basel, pp. 246-257.
- Foulkes, D. (1982). A cognitive-psychological model of REM dream production. Sleep, 5, 169-187.
- Foulkes, D. (1985). Dreaming: a cognitive-psychological analysis. New York: Lawrence Erlbaum Associates.
- Foulkes, D. & Rechtschaffen, A. (1964). Presleep determinants of dream content: the effects of two films. Perceptual and Motor Skills, 19, 983-1005.

- Foulkes, D. & Schmidt, M. (1983). Temporal sequence and unit composition in dream reports from different stages of sleep. Sleep, 6, 3, 265-280.
- Foulkes, D., Spear, P.S. Symonds, J.D. (1966). Individual differences in mental activity at sleep onset. Journal of Abnormal Psychology, 71, 280-286.
- Foulkes, D. & Vogel, G. (1965). Mental activity at sleep onset. Journal of Abnormal Psychology, 70, 231-243.
- Fowler, C.A. & Turvey, M.T. (1982). Observational perspective and descriptive level in perceiving and acting. In W.B. Weimer & D.S. Palermo (Eds.). Cognition and the Symbolic Processes, Vol. 2. Hillsdale, New Jersey: Lawrence Erlbaum Associates.
- Fransella, F. & Bannister, D. (1977). A Manual for Repertory Grid Technique. New York: Academic Press.
- Gaillard, J.M. (1979). Temporal organization of human sleep: general trends of sleep stages and their ultradian cyclic components. L'Encephale, V, 71-93.
- Garfield, P. (1973). Keeping a longitudinal dream diary. Psychotherapy: theory, research and practice, 10, 223-228.
- Garfield, P. (1974). Creative Dreaming. New York: Ballantine Books.
- Garner, W.R., Hake, H.W. & Eriksen, C.W. (1956). Operationism and the concept of perception. Psychological Review, 63, 149-159.
- Gendlin, E.T. (1977). Phenomenological concept vs. phenomenological method: a critique of Medard Boss on dreams. In C.E. Scott (Ed.) On Dreaming: an encounter with Medard Boss. California: Scholars Press.
- Gibson, E., Perry, F., Redington, D. & Kamiya, J. (1982). Discrimination of sleep onset stages: behavioral responses and verbal reports. Perceptual and Motor Skills, 55, 1023-1037.
- Goldstein, K.M. & Blackman, S. (1978). Cognitive Style. Five approaches and relevant research. Toronto: John Wiley & Sons.
- Goldstein, L., Stoltzfus, N.W. & Gardocki, J.F. (1972). Changes in interhemispheric amplitude relationships in the EEG during sleep. Physiology and Behaviour, 8, 811-815.
- Goodenough, D.R. (1967). Some recent studies of dream

- recall. In H.A. Witkin & H.B. Lewis (Eds.). Experimental Studies of Dreaming. New York: Random House, pp. 128-147.
- Goodenough, D.R. (1976). The role of individual differences in field dependence as a factor in learning and memory. Psychological Bulletin, 83, 4, 675-694.
- Goodenough, D.R. (1978). Dream recall: history and current status of the field. In A.M. Arkin et al (Eds.). The Mind in Sleep: psychology and psychophysiology. New Jersey: Lawrence Erlbaum Associates.
- Goodenough, D.R., Lewis, H.B., Shapiro, A., Jaret, L. & Sleser, I. (1965). Dream reporting following abrupt and gradual awakenings from different types of sleep. Journal of Personality and Social Psychology, 2, 170-179.
- Goodenough, D.R., Witkin, H.A., Lewis, H.B., Koulack, D. & Cohen, H. (1974). Repression, interference, and field dependence as factors in dream forgetting. Journal of Abnormal Psychology, 83, 32-44.
- Goodenough, D.R., Witkin, H.A., Koulack, D., & Cohen, H. (1975). The effects of stress films on dream affect and on respiration and eye movement activity during REM sleep. Psychophysiology, 15, 3, 313-320.
- Goodenough, D.R., Shapiro, A., Holden, M. & Steinschriber, L. (1959). A comparison of 'dreamers' and 'non-dreamers': eye movements, encephalograms, and the recall of dreams. Journal of Abnormal and Social Psychology, 59, 259-302.
- Hartmann, E. (1984). The Nightmare. The psychology and biology of terrifying dreams. New York: Basic Books.
- Hartmann, E. (1986). Nightmares and boundaries in the mind. ASD Newsletter, 3, 2, 1-2.
- Hauri, P. (1975). Categorization of sleep mental activity for psychophysiological studies. In G.C. Lairy & P. Salzarulo (Eds). The Experimental Study of Sleep. Amsterdam: Elsevier.
- Hauri, P., Sawyer, J. & Rechtschaffen, A. (1967). Dimensions of dreaming. A factored scale for rating dream reports. Journal of Abnormal Psychology, 72, 16-22.
- Hauri, P. & van de Castle, R. (1973). Psychophysiological parallels in dreams. In U.L. Jovanovic (Ed.). The Nature of Sleep. Stuttgart: Fischer.
- Hebb, D.O. (1960). The American revolution. American Psychologist, 15, 735-745.
- Hendricks, M. & Cartwright, R. (1978). Experiencing level

in dreams: an individual difference variable.
Psychotherapy: theory, research and practice, 15, 3,
292-298.

- Herman, J.H., Ellman, S.J., & Roffwarg, H.P. (1978). The problem of NREM recall re-examined. In A.M. Arkin et al (Eds.). The Mind in Sleep: psychology and psychophysiology. New Jersey: Lawrence Erlbaum Associates.
- Herman, J.H., Erman, M., Boys, R., Peiser, L., Taylor, M.E. & Roffwarg, H.P. (1984). Evidence for a directional correspondence between eye movements and dream imagery in REM sleep. Sleep, 7, 1, 52-63.
- Hiew, B. (1976). Unpublished data. Cited in Domhoff, W. (1985). The Mystique of Dreams. Los Angeles: University of California Press.
- Hobson, J. & McCarley, R. (1977). The brain as a dream state generator: an activation-synthesis hypothesis of the dream process. American Journal of Psychiatry, 134, 1335-1346.
- Hoffmann, R., Moffitt, A., Wells, R., Pigeau, R. & Shearer, J. (1984). Quantitative description of sleep stage electrophysiology using digital period analytic techniques. Sleep, 7, 4, 356-364.
- Holt, R.R. (1964). Imagery: the return of the ostracized. American Psychologist, 19, 254-264.
- Howard, G.S. (1982). Improving methodology via research on research methods. Journal of Counseling Psychology, 29, 3, 318-326.
- Howell, D.C. (1982). Statistical Methods for Psychology. Boston: Duxbury Press.
- Humphrey, N. (1983). Consciousness Regained. New York: Oxford University Press.
- Jones, R.A. (1977). Self-fulfilling Prophecies: social, psychological and physiological effects of expectancies. Toronto: Lawrence Erlbaum Associates.
- Jonte, D. (1979). Ego functions in a variety of dream states. Journal of Altered States of Consciousness, 4, 4, 305-319.
- Kamiya, J. (1961). Behavioral, subjective, and physiological aspects of drowsiness and sleep. In D.W. Fiske & S.R. Maddi (Eds.). Functions of Varied Experience. Homewood, Illinois: Dorsey Press.
- Kamiya, J. (1969). Operant control of the EEG alpha rhythm

and some of its effects on consciousness. In C. Tart (Ed.). Altered States of Consciousness. New York: Wiley.

Kelly, G. (1955). The Psychology of Personal Constructs. Volumes I & II. New York: Norton.

Kety, S. (1960). A biologist examines the mind and behavior. Science, 132, 1861-1870.

Kleitman, N. (1955). The role of cerebral cortex in the development and maintenance of consciousness. In H. Abrahamson (Ed.). Problems of Consciousness. New York: Josiah Macy Foundation.

Koella, W. (1981). Introduction. In Sleep 1980. Fifth European Congress on Sleep Research, Amsterdam, Karger, Basel.

Koukkou, M. & Lehmann, D. (1980). Brain functional states: determinants, constraints and implications. In M. Koukkou, D. Lehmann, & J. Angst (Eds.). Functional States of the Brain: their determinants. New York: Elsevier/North Holland, pp. 13-20.

Koukkou, M. & Lehmann, D. (1983). Dreaming: the functional state-shift hypothesis. British Journal of Psychiatry, 142, 221-231.

Kramer, M. (1982). The psychology of the dream: art or science? Psychiatric Journal of the University of Ottawa, 7, 2, 87-100.

Kramer, M., Czaya, J., Arand, D., & Roth, T. (1974). The development of psychological content across the REM. Paper presented at the Meeting of APSS, Jackson Hole, Florida.

Krippner, S., & Hughes, W. (1970). Dreams and human potential. Journal of Humanistic Psychology, 10, 1-20.

Kubicki, S., Hermann, W.M. & Holler, L. (1985). Critical comments on the rules by Rechtschaffen and Kales concerning the visual evaluation of EEG sleep records. In S. Kubicki & W.M. Hermann (Eds.). Methods of Sleep Research. New York: Gustav Fischer.

Laberge, S. (1985). Lucid Dreaming. The power of being awake and aware in your dreams. New York: Ballantine Books.

Ladd, G. (1892). Contributions to the psychology of visual dreams. Mind, 1, 299-304.

Langley, C.W. (1971). Differentiation and integration of systems of personal constructs. Journal of Personality, 39, 10-25.

- Larson, J.D. & Foulkes, D. (1968). Electromyogram suppression during sleep, dream recall and orientation time. Psychophysiology, 5, 548-555.
- Laughlin, C.D., McManus, J., & Shearer, J. (1983). Dreams, trance and visions: what a transpersonal anthropology might look like. Phoenix: The Journal of Transpersonal Anthropology, 7, 141-159.
- Laughlin, C.D., McManus, J. Rubinstein, R.A., & Shearer, J. (in press). The ritual transformation of experience. Studies in Symbolic Interaction, 7.
- Lehmann, D. & Koukkou, M. (1984). Physiological and mental processes during sleep: a model of dreaming. In M. Bosinelli & P. Cicogna (Eds.). Psychology of Dreaming. Bologna: Clueb.
- Lerner, B. (1967). Dream function reconsidered. Journal of Abnormal Psychology, 72, 85-100.
- Linton, C. (1974). Unpublished data reported by Witkin, H.A., Dyk, R., Fatereson, H.F., Goodenough, D.R. & Karp, S.A. (1974). Psychological Differentiation. New York: Wiley.
- Lowe, W.J. (1977). On using Heidegger. In C.E. Scott (Ed.). On Dreaming: an encounter with Medard Boss. California: Scholars Press.
- Mahrer, A. (1975). Metamorphosis through suicide: the changing of one's self by oneself. Journal of Pastoral Counseling, 10, 10-26.
- Mahrer, A. (1978). Experiencing. A humanistic theory of psychology and psychiatry. New York: Brunner/Mazel.
- Mahrer, A. (1986). Joining the dreamer in having the dream. Paper presented at the Third International Conference of the Association for the Study of Dreams, Carleton University, Ottawa, Ontario.
- Malcolm, N. (1959). Dreaming. New York: Humanities Press.
- Mancuso, J.C. & Adams-Webber, J.R. (Eds.). The Construing Person. (1982) New York: Praeger Press.
- Max, L.W. (1935). An experimental study of the motor theory of consciousness. III. Activation-current responses in deaf-mutes during sleep, sensory stimulation, and dreams. Journal of Comparative Psychology, 19, 469-486.
- McClelland, D.C. (1955). The psychology of mental content reconsidered. Psychological Review, 62, 297-302.

- Merica, H. & Gaillard, J.M. (1985). Statistical description and evaluation of the interrelationships of standard sleep variables for normal subjects. Sleep, 8, 3, 261-273.
- Michaels, C. & Carello, (1981). Direct Perception. New York: Prentice-Hall.
- Moffitt, A. & Hoffmann, R. (1987, in press). On the single-mindedness and isolation of dream psychophysiology. In J. Gackenbach (Ed.). A Sourcebook of Dreaming. New York: Garland Press.
- Moffitt, A., Hoffmann, R., Wells, R., Armitage, R., Pigeau, R. & Shearer, J. (1982). Individual differences among pre- and post-awakening EEG correlates of dream reports following arousals from different stages of sleep. Psychiatric Journal of the University of Ottawa, 7, 2, 111-125.
- Moffitt, A., Hoffmann, R., Wells, R., Armitage, R. & Shearer, J. (1985a). Dream psychology and psychophysiology. Paper presented at the symposium: Cognitive Psychology and Dreaming. Eastern Psychological Association meetings, Boston, March.
- Moffitt, A., Hoffmann, R., Wells, R. & Shearer, J. (1985b). Individual differences in the interrelation of states of sleeping and waking. Paper presented at the Association for the Study of Dreams meeting, Eastern Psychological Association meetings. Boston, Massachusetts, March.
- Moffitt, A., Hoffmann, R., Wells, R., Shearer, J. & Armitage, R. (1985d). Individual differences in the electrophysiological organization and interrelation of state: Stages REM and awake. Paper presented at the meetings of the Sleep Research Society, Satellite Symposium, Cognitive Processes During Sleep, Seattle, Washington, July.
- Moffitt, A., Purcell, S., Hoffmann, R., Pigeau, R. & Wells, R. (1985c). Dream Psychology: operating in the dark. Paper presented at the Symposium on Lucid Dreaming at the Second International Conference of the Association for the Study of Dreams, Charlottesville, Virginia, June.
- Monroe, L., Rechtschaffen, A., Foulkes, D. & Jensen, J. (1965). Discriminability of REM and NREM reports. Journal of Personality and Social Psychology, 2, 456-460.
- McNicol, D. (1972). Primer of Signal Detection Theory. London: Allen & Unwin.
- Natterson, J. (1980). The Dream in Clinical Practice. New

York: Jason Aronson.

Nielsen, T. (1983). Dreams as stories: structural analysis of sleep mentation. Unpublished doctoral dissertation. University of Alberta.

Nisbett, R.E. & Wilson, T.D. (1977). Telling more than we can know: verbal reports on mental processes. Psychological Review, 84, 231-259.

Okuma, T., Fukuma, E. & Hata, N. (1970). "Dream detector" automatization of REM-awakening technique for the study of dreaming. Psychophysiology, 7, 508-515.

Orlinsky, D. (1962). Psychodynamic and cognitive correlates of dream recall- a study of individual differences. Unpublished doctoral dissertation, University of Chicago.

Pennebaker, J.W. & Epstein, D. (1983). Implicit psychophysiology: effects of common beliefs and idiosyncratic responses on symptom reporting. Journal of Personality, 51, 3, 468-496.

Pivik, R.T. (1978). Tonic states and phasic events in relation to sleep mentation. In A.M. Arkin et al (Eds.). The Mind in Sleep: psychology and psychophysiology. New Jersey: Lawrence Erlbaum Associates.

Pivik, R.T. & Foulkes, D. (1968). NREM mentation: relation to personality, orientation time, and time of night. Journal of Consulting and Clinical Psychology, 37, 144-151.

Platt, J.R. (1964) Strong inference. Science, 146, 347-353.

Purcell, S., (1987). The experimental entrainment of self-reflective and intentional dreaming in High and Low Frequency recallers. Ph. D. Dissertation in progress, Carleton University, Department of Psychology.

Purcell, S., Mullington, J., Moffitt, A., Hoffmann, R. & Pigeau, R. (1986). Dream self-reflectiveness as a learned cognitive skill. Sleep, 9, 3, 423-437.

Ramsey, G.V. (1953). Studies of dreaming. Psychological Bulletin, 50, 432-455.

Rechtschaffen, A. (1973). The psychophysiology of mental activity during sleep. In F. McGuigan & R. Schoonover (Eds.). The Psychophysiology of Thinking. New York: Academic Press.

Rechtschaffen, A. (1978). The singlemindedness and isolation of dreams. Sleep, 1, 1, 97-110.

- Rechtschaffen, A. & Buchignani, C. (1983). Visual characteristics of the dream. Paper presented at the annual meeting of the Sleep Research Society, Bologna, Italy.
- Rechtschaffen, A. & Kales, A. (1968). A manual of standardized terminology, techniques and scoring system for sleep stages of human subjects. National Institute of Health Publication, Washington, D.C. U.S. Government Printing Office.
- Rechtschaffen, A., Verdone, P. & Wheaton, J. (1963). Reports of mental activity during sleep. Canadian Psychiatric Association, 8, 409-414.
- Redington, D. (1985). Application of artificial intelligence to dream research. Association for the Study of Dreams Newsletter, 2, 4, 8-9, 12.
- Redington, D., Perry, F., Gibson, E. & Kamiya, J. (1981). Discrimination of early sleep stages: behavioral indicators. Sleep, 4, 2, 171-176.
- Reed, H. (1973). Learning to remember dreams. Journal of Humanistic Psychology, 13, 33-48.
- Reed, H. (1976). Dream incubation: a reconstruction of a ritual in contemporary form. Journal of Humanistic Psychology, 16, 4, 53-70.
- Reinsel, R., Antrobus, J. & Wollman, M. (1983). The phasic-tonic difference and the time-of-night effect. In M.C. Chase & W.C. Stern (Eds.). Sleep Research, Los Angeles: Brain Service, p. 115.
- Rorschach, H. (1942). Psychodiagnostics: a diagnostic test based on perception. Berne: Hans Huber.
- Rosch, E. & Lloyd, B.B. (1978). Cognition and Categorization. Toronto: Lawrence Erlbaum Associates.
- Rossi, E.L. (1986). The Psychobiology of Mind-Body Healing. New York: W.W. Norton.
- Schachter, H.M. (1983). Ecological Science: preliminaries for a paradigm shift? Unpublished Ph.D. comprehensive examination, Carleton University, Department of Psychology, Ottawa, Canada.
- Schacter, D. (1976). The hypnagogic state: a critical review of the literature. Psychological Bulletin, 83, 452-481.
- Schonbar, R.A. (1965). Differential dream recall frequency as a component of, 'life style'. Journal of Consulting

- Schwartz, D., Weinstein, L.N. & Arkin, A.M. (1978). Qualitative aspects of sleep mentation. In A.M. Arkin et al (Eds.). The Mind in Sleep: psychology and psychophysiology. New Jersey: Lawrence Erlbaum Associates.
- Seligman, M.E.P. (1970). On the generality of the laws of learning. Psychological Review, 77, 406-418.
- Sewitch, D.E. (1984). The perceptual uncertainty of having slept: the inability to discriminate electroencephalographic sleep from wakefulness. Psychophysiology, 21, 3, 243-259.
- Shapiro, A., Goodenough, D.R., Lewis, H.B., & Sleser, I. (1965). Gradual arousal from sleep: a determinant of thinking reports. Psychosomatic Medicine, 27, 342-349.
- Shearer, J. (1977). Precursors to a science of consciousness. Unpublished M.A. thesis, Goddard College.
- Sheldrake, P. & Cormack, M. (1974). Cyclicity in dreaming: patterns in dream preoccupations for men and women. International Journal Chronobiology, 2, 217-221.
- Smith, E.E. & Medin, D.L. (1981). Categories and Concepts. Cambridge, Massachusetts: Harvard University Press.
- Snyder, F. (1970). The phenomenology of dreaming. In H. Madow & L.H. Snow (Eds.). The Psychodynamic Implications of the Physiological Studies on Dreams. Springfield, Illinois: C.C. Thomas.
- Stern, D.A., Saayman, G. & Touyz, S. (1978). A methodological study of the effect of experimentally induced demand characteristics in research on nocturnal dreams. Journal of Abnormal Psychology, 87, 459-466.
- Stoyva, J. & Kamiya, (1968). Electrophysiological studies of dreaming as the prototype of a new strategy in the study of consciousness. Psychological Review, 75, 192-205.
- Strauch, F. (1969). Psychological aspects of dream recall. Paper presented at a symposium on sleep and dreaming. 19th International Congress of Psychology, London, July.
- Swets, J.A. (1986a). Indices of discrimination or diagnostic accuracy: their ROCs and implied models. Psychological Bulletin, 99, 1, 100-117.
- Swets, J.A. (1986b). Form of empirical ROCs in discrimination and diagnostic tasks: implications for theory and measurement of performance. Psychological Bulletin,

- Tart, C. (1975). States of Consciousness. New York: E.P. Dutton.
- Thayer, R.E. (1967). Measurement of activation through self-report. Psychological Reports, 20, 663-678.
- Thayer, R.E. (1970). Activation states as assessed by verbal report and four psychophysiological variables. Psychophysiology, 7, 1, 86-94.
- Thayer, R.E. (1978a). Toward a psychological theory of multidimensional activation (arousal). Motivation and Emotion, 2, 1, 1-34.
- Thayer, R.E. (1978b). Factor analytic and reliability studies on the Activation-Deactivation Adjective Check List. Psychological Reports, 42, 747-756.
- Tracy, R.L. & Tracy, L.N. (1974). Reports of mental activity from sleep stages 2 and 4. Perceptual and Motor Skills, 38, 647-648.
- Urbina, S.P. (1981). Methodological issues in the quantitative analysis of dream content. Journal of Personality Assessment, 45, 71-78.
- Verdone, P. (1965). Temporal reference of manifest dream content. Perceptual and Motor Skills, 20, 1253-1268.
- Vogel, G., Foulkes, D. & Trosman, H. (1966). Ego functions and dreaming during sleep onset. Archives of General Psychiatry, 14, 238-248.
- Vogel, G., Barrowclough, B. & Giesler, D. (1972). Limited discriminability of REM and SO reports and its psychiatric implications. Archives of General Psychiatry, 26, 449-455.
- Wallach, M.S. (1963). Dream report and some psychological concomitants. Journal of Consulting Psychology, 27, 549.
- Walsh, J.K., Tepas, D.I. & Moss, P.D. (1981). The EEG sleep of night and rotating shift workers. In L.C. Johnson et al (Eds.). Biological Rhythms, Sleep and Shift Work: Advances in Sleep Research, Volume 7. New York: Spectrum Publications.
- Wang, P. (1980). Interaction between handedness and cerebral functional dominance. International Journal of Neuroscience, 11, 35-40.
- Watzlawick, P. (1984). The Invented Reality. New York: W.W. Norton.

Webb, W.B. & Campbell, S.S. (1979). The first night effect revisited with age as a variable. Waking and Sleeping, 3, 319-324.

Webb, W.B. & Cartwright, R. (1978). Sleep and dreams. Annual Review of Psychology, 29, 223-252.

Wells, R., Shearer, J., Moffitt, A., Hoffmann, R., & Sussman, P. (1978). Concomitants of dream recall. Unpublished paper, Carleton University, Department of Psychology.

Williams, S.K. (1980). Jungian-Senoj Dreamwork Manual. Berkeley, California: Journey Press.

Winget, C. & Kramer, M. (1979) Dimensions of Dreams. Gainesville, Florida: University of Florida.

Witkin, H.A., Dyk, R., Faterson, H.F., Goodenough, D.R. & Karp, S.A. (1974). Psychological Differentiation. New York: Wiley.

Witkin, H.A. & Goodenough, D.R. (1981). Cognitive Styles: essence and origins. New York: International Universities Press.

Witkin, H.A., Goodenough, D.R. & Oltman, P.K. (1979). Psychological differentiation: current status. Journal of Personality and Social Psychology, 37, 7, 1127-1145.

Witkin, H.A., Oltman, P.K., Raskin, E. Karp, S.A. (1971). A Manual for the Embedded Figures Test. Palo Alto: Consulting Psychologists Press.

Wolman, B.B. (1979). Handbook of Dreams: research, theory and applications. Toronto: Van Nostrand Reinhold.

Wolpert, E.A. & Trosman, H. (1958). Studies in the psychophysiology of dreams. I. Experimental evocation of sequential dream episodes. Archives of Neurology and Psychiatry, 70, 603-606.

Zimmerman, W.B. (1970). Sleep mentation and auditory awakening thresholds. Psychophysiology, 6, 540-549.

APPENDIX -A
(Study #1)

Appendix A1: Initial Contact for Pilot Study

My name is Howard Schachter. I'm from the Sleep Lab. I'm looking for volunteers who are willing to take part in a sleep study that I'm about to run in our sleep lab. I am looking for right-handed males whose immediate family members are right-handed as well: that is, parents, brothers, sisters. In addition, each of you must be currently recalling your dreams very often. That is, you must be recalling at least one dream virtually every night, and with rare exception. You will be asked to sleep a number of nights in our lab.

By taking part you will receive 4 participation credits. If you already have some of your 4 credits, then participating in this study will allow you to complete your 4 credits. Your participation would be greatly appreciated. If you are interested then please phone me in the next day or so, and at the sleep lab: 564-4349. Thanks very much.

Appendix A2: Follow-up Information

You will sleep 6 consecutive nights in the lab. You will be told what to expect when you first come to the lab. The study will entail a number of awakenings per night. You must sleep between 7 and 8 hours regularly per night. I'll ask you to abstain from all alcohol and drug consumption while you're participating in the study. Are you interested? If so, let's schedule you. Let's do it so that you go to bed about the same time each night. OK? Note that you can bring your own pillow or covers if you wish. If not we are fully equipped. Thanks.

Appendix A3: Instructions on the Pre-test Night

This study was designed to investigate two types of sleep called Stage REM and Stage 2. Your task during the night involves the following: you will be awakened a number of times from each of these two types of sleep and on each occasion you will be asked to tell me the type of sleep you feel you were in before I awakened you, Stage 2 or Stage REM. That is, on each occasion you will be asked to identify the type of sleep from which you were awakened. You may use any criteria you wish in helping you to decide. However, you will not be told whether your decision was correct or not.

If you have any questions regarding what you are supposed to do, don't hesitate to ask them now.

Appendix A4: Wakeup Protocol for Pre-test and Post-test Nights

1. [name], wake up, keep your eyes closed and remain as still as you possibly can.

Proceed once the S shows clear signs of awakening: eg. some movement, a response, etc.

2. Could you please tell me the type of sleep you were in before I called your name?

If a S requests a restatement of response options, then the first time in the study the E responds: Stage REM or Stage 2. On the next occasion the E responds: Stage 2 or Stage REM. The order is alternated across requests.

3. OK, now-- where 1 is 'not sure at all', 2 is 'pretty sure' and 3 is 'definite', use these options to rate how certain you are of your judgment. How certain are you of your judgment?

After the S becomes accustomed to the procedure the question may be asked on its own once the response alternatives are given.

4. What criteria did you use in making the decision as to the type of sleep you were in? How did you go about deciding that you were in []?

The E jots down criteria in spite of the fact that all wakeups are audiotaped.

5. Thanks alot-- you can go back to sleep now.

Appendix A5: The Description for Training Nights

Each S reads this description before the hook-up.

The following is intended to familiarize you a little bit with some of the interesting things known about the two types of sleep of concern in this study. This information is based on research procedures which are different from the one employed in the present study. [Describe report-evaluation and probe techniques, and stress fact that these strategies did not rely on subjects' awareness of a REM/2 state difference.]

As mentioned on the first night that you spent in this laboratory, the two sleep stages of interest in this study are called Stage REM and Stage 2. Each is defined by patterns of: 1) brain electrical activity (EEG) measured via electrodes placed on the scalp; 2) eye movement activity (EOG) measured via electrodes affixed beside the eyes; and 3) changes in muscle tone (EMG) measured via electrodes attached under the chin.

Stage 2 (see Figure 1) is defined by the emergence of two EEG events which occur periodically against a background of the predominant brain electrical activity which is relatively low voltage, mixed frequency EEG. The two transient EEG events are: 1) brief bursts of fast-wave, low voltage spindle-like activity; and 2) high voltage spikes called K-complexes which are sharply rising and falling, high amplitude delta waves. These delta waves may comprise up to 20 percent of Stage 2 EEG. Finally, muscle tone is present while eye movements are typically absent.

Stage REM (see Figure 2) is defined by: 1) relatively low-voltage, mixed frequency EEG; 2) fast, conjugate eye movements; and 3) a loss of anti-gravity muscle tone. Consequently, Stages 2 and REM are most dissimilar in that only the former includes the 2 periodic EEG events called spindles and K-complexes while only the latter includes the abrupt, sharp eye movements as well as marked loss of muscle tone.

Ever since these two types of sleep stage were discovered, researchers have awakened subjects from these two stages and have then asked them to report any experiences that they may have had prior to, as well as during, the awakening. This research strategy has revealed a number of findings regarding the similarities and differences between the typical experiences associated with these two sleep states. A summary of these findings will be presented in a moment. But first, a note about some definitions pertinent to this study.

The attitude adopted in this study is that any experience occurring during sleep is called a sleep experience, providing you feel that it occurred during the pre-awakening sleep state. Furthermore, the experience of waking up may be described as involving the transition from the pre-awakening state and into the waking state. Consequently, in this study asking you to identify the type of sleep from which you were awakened amounts to asking whether you can identify, and distinguish between, two sleep states defined by experiential factors (eg. perceiving, acting, etc.) and that correspond to the two types of sleep stage defined by EEG, EOG, and EMG patterns. That is, can you identify, and distinguish between, a Stage REM and Stage 2 sleep state

using experience information?

Examples of sleep experience include visual experience which has typically defined the presence of 'dreaming'. However, dreaming defined in this way is only one kind of sleep experience. Seeing, hearing, acting, feeling, thinking, remembering, forgetting, imagining, etc. are all kinds of experience that may occur during sleep. These may happen in any combination or alone. Furthermore, experience while asleep can be experience-of 'something' such as a 'dream-world' (also called sleep-world) which may include people, objects or places.

On the other hand, experiences such as thinking or feeling can occur without the presence of a visually perceivable 'dream-world'. As well, experience can involve familiar or unfamiliar people, objects or places. In short, the attitude held in this study is that any kind of experience that may occur during waking can also occur during sleeping. Thus, the major difference between the two sets of experience is not what happens but rather the time of the experience in question: that is, whether it occurs during waking or sleeping.

The following is a summary of findings from the traditional research literature regarding the similarities and differences between typical sleep and waking up experiences associated with the two sleep stages. One of the major findings reported in the literature is that the sleep experiences associated with the two types of sleep are often so similar in terms of the qualities to be described here that researchers and subjects alike cannot tell them apart. That is, many experiences obtained when subjects are awakened from Stages REM or Stage 2 are indistinguishable when evaluated in terms of these qualities. On the other hand, some differences have been reported.

For instance, awakenings from Stage REM are more often associated with a report of having had a dream (ie. visual/perceptual experience) during the pre-awakening state than are awakenings from Stage 2. However, the time of night that wakeups are performed may sometimes influence whether there will be a dream to report. 'Early in the night' refers to the first half of the night or so while 'later in the night' refers to the last half of the night or so. For example, for each of Stage REM and Stage 2, dream recall rates are higher later in the night than earlier in the night. Moreover, the likelihood of having a dream to report increases for Stage 2 as the night progresses so that the Stage 2 recall rate later in the night may reach a level similar to the REM recall rate early in the night.

When sleep experience is reported, typical REM experience tend to be more dreamlike than are typical Stage 2 experiences in the sense that the former are more likely to involve perceptual experience (eg. seeing). Nevertheless, perceptual experience does occur in Stage 2 and the likelihood of perceptual experience increases for both stages as the night progresses. Furthermore, Stage 2 experience late at night is similar to REM experience early in the night in that the experience is typically perceptual in nature. On the other hand, while thinking as an activity during sleep does occur in both stages, it is reported to occur in both stages. However, experience that involves

thinking as the sole activity, and unassociated with perceiving or acting, tends to occur more often in Stage 2 than in REM. In addition, experiences reported early in the night for both stages have tended to be more thought-like than are experiences reported later on in the night. Overall however, perceptual and thinking experiences occur in both sleep states.

When dream experiences are reported by awakened subjects, those associated with Stage REM awakenings have typically been characterized by a greater involvement in the 'dream-world' on the part of the dreamer than for Stage 2 experiences. That is, the dreamer in Stage REM is more likely to actively participate in dream events, have direct physical contact with dream characters or objects, and experience or express feelings than in Stage 2 experiences. Furthermore, the overall activity level in Stage REM dreams exceeds that of Stage 2 dreams.

On the other hand, the dreamer in Stage 2 is more likely to have an experience of less involvement in that there is a passive observation of dream events (non-participatory involvement on the dreamer's part), less direct physical contact, and less of an emotional involvement. However, Stage 2 and REM experiences are often indistinguishable in that they exhibit more and less involvement, respectively, than is characteristic of their typical experiences. Finally, Stage 2 experience obtained late in the night is likely to be similar to Stage REM experience early in the night in terms of the dreamer's involvement; and, experiences from both stages often exhibit greater involvement on the dreamer's part as the night progresses.

REM experiences have been reported to last longer as well as involve a greater number of human characters and (dream) scene changes than do Stage 2 experiences. That is, REM experiences are elaborated to a greater extent than are Stage 2 experiences. However, Stage 2 and REM experiences are often indistinguishable in that they exhibit greater and lesser elaboration, respectively, than is characteristic of their typical experiences. In fact, Stage 2 experiences late in the night are often similar to REM experiences early in the night. Finally, experiences associated with both stages are elaborated to a lesser extent early in the night than later on in the night.

REM experiences are also more likely to exhibit the quality of being a continuous, vivid and clear 'story' while Stage 2 experiences are less likely to show this quality. That is, these latter experiences are reported to be more fragmented and cut-up, less vivid and clear in nature. However, Stage REM and 2 experiences are often indistinguishable in that they exhibit lesser and greater continuity/clarity (or 'flow'), respectively, than is characteristic of their typical experiences. Some Stage 2 experiences late in the night are similar to REM experiences early in the night. Finally, experiences associated with both stages tend to be less continuous early in the night than later on in the night.

When subjects have been awakened from Stage REM they were likely to report having experienced pre-awakening sleep that was more relaxed and sound than when awakened from Stage 2. The latter was more likely to have been characterized by a restless and agitated sleep. Furthermore, regardless of whether

there was a sleep experience (eg. a dream) to report or not, subjects questioned upon arousal from Stage 2 reported on many occasions that they had felt they had been awake prior to being awakened by the researcher. Reports of having been awake prior to the wakeup were more likely to be associated with Stage 2 than REM while most arousals from REM yielded reports of having been asleep. However, reports of having been awake were also obtained following arousal from Stage REM.

In conclusion, despite some differences, experiences from both sleep states share considerable common ground and especially when time of night is taken into account. Consequently, some authors in the literature have suggested that subjects may have difficulty performing this discrimination task (cf. Foulkes, 1985). However, as yet there are not enough data to conclude that this task is or is not possible for subjects to succeed at. Therefore, this study was undertaken to address this issue.

It must be stressed that this researcher is uncertain as to whether anyone can perform this task successfully. Furthermore it must also be made clear that the description that you just read contains information which may or may not be useful to you in helping guide what it is that you will be asked to do in this study. The information may be no more useful than your own criteria. Therefore, use what works for you: this information, your own, or some combination of the two. Different individuals might use different criteria. Use whatever helps you in guiding your responses. You are not obliged to use this information.

Your task for tonight involves the following: upon being awakened from these two types of sleep you will be asked to: 1) identify the type of sleep you feel you were awakened from, using any criteria you wish; and 2) respond to a number of questions. Furthermore, you will be told whether your judgments are correct. Do you have any questions?"

Appendix A6: Wakeup Protocol for Training Nights

1. [name], wake up, keep your eyes closed and remain as still as you possibly can.

Proceed once the S shows signs of awakening.

2. Could you please tell me the type of sleep you were in before I called your name.

Follow the procedure described in Wakeup Protocol for other nights with reference to reminders of the stage name options.

3. OK, now-- where 1 is 'not sure at all', 2 is 'pretty sure' and 3 is 'definite', how certain are you of your judgment?

4. What criteria did you use in making your decision? How did you go about deciding that you were in []?

5. [The E then asks the question-probes. Cards with one probe per card are drawn at random from a brown envelope. All questions are asked until there are none remaining.]: I'm going to ask you some questions now. Each of these questions is to be rated by you using a scale that I will read to you; and, unless I specify otherwise, questions pertain to the period of time just before I awakened you. OK-- where 1 is 'yes' and 2 is 'no', do you have a sleep experience that you could report if I asked you to do so? [The 'Recall' probe] OK-- let's go on... [Ask the remaining 16 questions: see Appendix A7]

6. [Feedback is given regarding discrimination performance]: Yes, that was a []. OR No, that wasn't a []; it was a [].

7. Thanks alot-- you can go back to sleep now.

Appendix A7: The Question-probes

- 1) Directness of Physical Contact: Where 1 is 'no physical contact at all' and 7 is 'with direct physical contact', did you experience any physical contact with someone or something?
- 2) Clarity of Sensory Experience: Where 1 is 'not at all' and 7 is 'very clearly', did you see or hear anyone or anything?
- 3) Feeling Intensity: Where 1 is 'not at all' and 7 is 'very intensely', did you experience any feelings?
- 4) Time Spent Thinking: Where 1 is 'not at all' and 7 is 'all the time', were you thinking?
- 5) Complexity of Experience: Where 1 is 'nothing at all' and 7 is 'alot was happening', what was going on?
- 6) Number of Human Characters: Where 1 is 'none at all' and 7 is 'very many', were there other human characters present?
- 7) Number of Scenes: Where 1 is 'no experience at all' and 7 is 'there were many different scenes', what was going on?
- 8) Clarity of Sense of Oneself as a Person: Where 1 is 'not at all' and 7 is 'very vividly and clearly', did you have a sense of who you were as a person?
- 9) Complexity of Color: Where 1 is 'none at all' and 7 is 'many different ones', was there any color?
- 10) Depth of Sleep: Where 1 is 'deep asleep' and 7 is 'wide awake', rate how you felt before you heard me call your name.
- 11) Sleep Quality: Where 1 is 'restless and agitated' and 7 is 'relaxed and sound', rate your sleep.
- 12) Continuity of Experience: Where 1 is 'very fragmented and cut-up' and 7 is 'very continuous', rate the quality of your experience.
- 13) Time Spent Observing Passively: Where 1 is 'never' and 7 is 'the whole time', did you spend time observing things in a passive fashion?
- 14) Time Spent Participating Actively: Where 1 is 'never' and 7 is 'the whole time', did you spend time participating actively in events?
- 15) Length of Experience: Where 1 is 'there was no experience' and 7 is 'a very long time', how long did the experience last?
- 16) Vividness of Sleep/Dream-World: Where 1 is 'nothing at all' and 7 is 'a very vivid and well-defined sleep-world' was there anything to notice while you were asleep?

Appendix A8: AM Inquiry for Training Nights and Following Final Post-test Night

1. How do you feel right now?
How did you sleep last night?
2. Did you use a particular strategy to help you make your decisions about the stage from which you were awakened? If so, could you describe it?
3. What best describes the differences between experiences associated with these two sleep stages? The similarities?

Appendix A9: Protocol for Embedded Figures Test (Form A)

Standard instructions are given (Witkin et al, 1971) once the S is seated, and a set of trial cards is used to explain the procedure. A complex figure is shown to S for 15 seconds and after this time has elapsed, a simple figure is then presented to the S for 10 seconds. The card with the simple design on it is always placed over the complex figure so that the two are never seen together. At the end of the 10 seconds, the card is flipped over, revealing the complex figure. At this time the stopwatch is started. The S is told to begin to search for the simple figure which is embedded in the complex one, and to indicate to the E if he wants to see the simple figure again. Upon such a request the E places the simple figure on top of the complex one, thereby hiding the latter from view. The simple figure is left in this position for 10 seconds before being removed, and the stopwatch is stopped during this 10-second interval. The watch is started again once the simple figure is removed. This enables the E to obtain a score for 'search time' only. The final score is the mean time for completing 12 trials, and it is expressed in seconds.

Appendix A10: Final Inquiry Questions

1. What are the clear-cut differences between experiences from Stages REM and 2?
2. What source of information, if any, influenced your performance in this study? What helped your strategy most? least?
3. Which were your best criteria for deciding which stage you were in?

Appendix All: The Differentiation Task

This task was designed to see whether Ss would be able to differentiate between their prototypical REM and Stage 2 experiences on the basis of the psychological differentiation construct (cf. Witkin & Goodenough, 1981). The fact that these might be discriminable on this basis is related to a speculative interpretation of the extant literature.

Foulkes and Rechtschaffen (1964) as well as Rechtschaffen et al (1963) have likened NREM experience to phenomenology associated with conditions of sensory deprivation and sensory monotony. Therefore, since one's sense of self-nonsel self segregation or differentiation has been noted to become disturbed (eg. decreased) under these conditions (eg. Fiske & Maddi, 1961), it may be the case that Stage 2 experience entails less organismic involvement concomitant with a relatively (to REM experience) lower level of self-nonsel self differentiation.

Therefore, Ss were asked to look through a set of Human Figure Drawings pre-scored for psychological differentiation and which were contained in Witkin et al's (1971) manual. Two Human Figures were selected to represent each of the five possible levels or scores. All Figures were male, and added to these ten photocopied drawings was a single blank sheet to represent the absence of self-nonsel self differentiation predicated on the absence of self and nonself.

Each S was then instructed to: Select the one Human Figure Drawing which best captures how you typically felt in relation to your Stage REM sleep-world. Once this was completed a second request was made. Each S was then to look at these drawings again and: Select the one which best captures how you typically felt in relation to your Stage 2 sleep-world. The E recorded the Figures selected and the differentiation scores associated with these drawings. The blank sheet represented a '1' while the highest score possible was '6'. The latter denoted the greatest degree of self-nonsel self differentiation.

Precedence for such a nonverbal, matching procedure comes from a study by Rechtschaffen and Buchignani (1983). They used variations of a single photograph to index vividness, chromaticity, etc. and Ss were asked to select the one best capturing their pre-arousal experience.

Appendix A12: Wakeup Schedules for Pilot Study

Wakeup schedules for the pre-test and training nights were developed to control for a possible biasing of wakeups for time of night. There are 6 different blocks of 4 wakeups possible which satisfy the requirement that there be an equal number of REMs and Stage 2s (ie. R22R, RR22, 22RR, R2R2, 2R2R, 2RR2). The strategy used to develop a schedule for any one night involved a random selection of blocks, with restriction.

In order to counterbalance for wakeup blocks across time of night, blocks were selected without replacement. The first two blocks constituted the pre-test night, where Blocks 1 and 2 were the Earlier and Later parts of the night, respectively. The next two blocks became the Earlier and Later segments of the first training night, respectively. Then, blocks were reversed. Blocks 1 and 2 became the Later and Earlier parts of training night 2; and, Blocks 3 and 4 became the Later and Earlier segments of training night 3.

Each S was assigned a schedule for post-test nights that could differ from other Ss'. Blocks were used to generate time of night segments on post-test night 1 which were then reversed for post-test night 2. The following are the schedules for Ss:

All Ss' Pre-test Night

REM
2
REM
2
2
REM
2
REM

All Ss' Training Nights

<u>#1:</u>	<u>#2</u>	<u>#3</u>
REM	2	REM
REM	REM	2
2	2	2
2	REM	REM
REM	REM	REM
2	2	REM
2	REM	2
REM	2	2

Post-test Nights

Subject 1

2	2
2	REM
REM	2
REM	REM
2	2
REM	2
2	REM
REM	REM

Subject 2

REM	2
REM	REM
2	2
2	REM
2	REM
REM	REM
2	2
REM	2

Subject 3

2	REM
REM	2
2	2
REM	REM
REM	2
2	REM
2	2
REM	REM

Subject 4

REM	2
REM	REM
2	REM
2	2
2	REM
REM	REM
REM	2
2	2

Subject 5

2	2
REM	REM
REM	2
2	REM
2	2
REM	REM
2	REM
REM	2

Appendix A13: Additional Conventions for Wakeups

If a state change or excessive movement precludes reaching the 5 minute minimum, the next instance of the target stage must be awaited. A state change or excessive movement of greater than 15 seconds duration after the minimum has been surpassed signals an immediate awakening. If the minimum has been met and the S goes back into target stage after less than 15 seconds of a state change or excessive movement, then the E must wait to get the 8 minute maximum.

A correct stage, spontaneous arousal from a scheduled awakening period meeting the 5-8 minute criterion will be used to replace the experimental arousal. If an inappropriate (eg. target=REM, current stage= 2) spontaneous arousal occurs, the S will be urged to go back to sleep. Regarding spontaneous arousal for 'bathroom' requirements, standard conventions practised by the Sleep Lab will be employed.

These rules were developed because of the possibility that 'loss' of a recallable experience might occur if the S moves from one stage (eg. REM), into another (eg. Stage 2), and then into wakefulness. If recall depends on the state from which the S has exited and the state into which the S enters (cf. Koukkou & Lehmann, 1983), then an attempt will be made to obtain data from sleep stages that are as homogeneous as possible.

APPENDIX B
(Study #1)

TABLE 1: Discrimination Performance at Post-test

a. All trials

<u>Subject</u>	<u>x2</u>	<u>df</u>	<u>p</u>	<u>kappa</u>	<u>df</u>	<u>p</u>	% Correct	
							<u>REM</u>	<u>Stage 2</u>
All	7.366	1	.0066	.52	1	.0012	72.5 (29/40)	57.5 (23/40)
S1	0	1	1	0	1	1	50 (4/8)	50 (4/8)
S2	7.273	1	.007	.625	1	.004	100	62.5
S3	1.333	1	.2482	.25	1	.1423	87.5	37.5
S4	4.267	1	.0389	.5	1	.017	62.5	87.5
S5	.254	1	.6143	.125	1	.2981	62.5	50

b. Recalls Only

S1	0	1	1	0	1	1	60 (3/5)	60 (3/5)
S2	2.12	1	.101	.42	1	.098	100 (7/7)	50 (1/2)
S3	.88	1	.4622	.196	1	.3154	87.5 (7/8)	83.3 (5/6)
S4	1.89	1	.2164	.31	1	.2449	83.3 (5/6)	50 (1/2)
S5	2.56	1	.443	.495	1	.3569	66.7 (4/6)	60 (3/5)

TABLE 2: Frequency Counts of S2's Phenomenological Descriptions
at Post-test

<u>Criteria</u>	a.		b.	
	<u>All</u> <u>REM</u> (n=8)	<u>Trials</u> <u>Stage 2</u> (8)	<u>Recalls Only</u> <u>REM</u> (7)	<u>Stage 2</u> (2)
Dreaming	7	2	7	2
Not dreaming	0	5	-	-
Part of dreaming, involved in it	6	1	6	1
Not part of dreaming, looking in from distance	0	1	0	1
Thinking	0	1	0	0
Expressed feelings	1	0	1	0
Many people	1	0	1	0
Erection, aroused	4	0	4	0
Not aroused	1	4	1	1
rapid eye motion	1	0	1	0
Not asleep	0	1	0	1
Guessed	0	1	0	0

TABLE 3: Frequency Counts of S4's Phenomenological Descriptions at Post-test

<u>Criteria</u>	a.		b.	
	<u>All</u> <u>REM</u> (n=8)	<u>Trials</u> <u>Stage 2</u> (8)	<u>Recalls Only</u> <u>REM</u> (6)	<u>Stage 2</u> (2)
Dreaming	6	2	6	2
Present as character in experience (eg. see hand or part of me)	3	0	3	0
Not in it as flesh & blood character	3	1	3	1
No dreaming	2	5	-	-
Forget experience	0	1	-	-
Very vivid & explicit	4	0	4	0
Fairly vivid & clear	0	1	0	1
Very detailed	1	0	1	0
Auditory experience	1	0	1	0
Many, other characters	4	0	4	0
No people	1	0	1	0
Single, fairly well-developed plot	2	0	2	0
Color	4	0	4	0
No color	1	0	1	0
Speech	1	0	1	0
Awake	0	1	0	1

TABLE 4: Frequency Counts of S1's Phenomenological Descriptions at Post-test

<u>Criteria</u>	a.		b.	
	<u>All</u> <u>REM</u> (n=8)	<u>Trials</u> <u>Stage 2</u> (8)	<u>Recalls Only</u> <u>REM</u> (5)	<u>Stage 2</u> (5)
Experience	5	5	5	5
Not sure if dreamt	1	0	1	0
Easy to recall	1	0	1	0
Trouble recalling it	1	3	1	3
No recall	2	2	-	-
Active involvement, participation	1	1	1	1
Not involved physically	1	1	1	1
Real(istic) & tangible experience eg. real characters	2	1	2	1
Long, continuous dream	2	2	2	2
Storylike & complete	2	3	2	3
Events occurred quickly & jumbled together	1	0	1	0
Deep asleep	1	0	0	0
Awake	1	0	1	0
Not much sleep	0	2	0	1

TABLE 5: Frequency Counts of S5's Phenomenological Descriptions at Post-test

<u>Criteria</u>	a.		b.	
	<u>All</u> <u>REM</u> (n=8)	<u>Trials</u> <u>Stage 2</u> (8)	<u>Recalls</u> <u>REM</u> (6)	<u>Only</u> <u>Stage 2</u> (5)
Recallable experience	6	5	6	5
Trouble recalling	0	1	0	1
Not dreaming	1	0	-	-
Continuous & flowing experience	4	2	4	2
Physical contact	5	2	5	2
Little contact	1	0	1	0
No physical contact	0	1	0	1
Emotion	1	2	1	2
A lot of thinking	1	1	1	1
Deep asleep, didn't move	1	1	1	0
Not asleep	0	1	0	0
Guess	1	1	0	0

TABLE 6: Frequency Counts of S3's Phenomenological Descriptions
at Post-test

<u>Criteria</u>	a.		b.	
	<u>All</u> <u>REM</u> (n=8)	<u>Trials</u> <u>Stage 2</u> (8)	<u>Recalls Only</u> <u>REM</u> (8)	<u>Stage 2</u> (6)
Experience	8	6	8	6
Nothing, just dark	0	1	0	1
Participating, moving, activity	6	3	6	3
Others active	0	1	0	1
Real life	1	0	1	0
Visual experience	2	0	2	0
Physical feelings	2	0	2	0
Less intricate experience	0	1	0	1
Thoughts	0	1	0	1
Not asleep	0	1	0	0

TABLE 7: Incidence of Recallable Experience for Post-test and Training Nights *

	Post-test					Training				
	χ^2	df	p	% Recall		χ^2	df	p	% Recall	
				REM	St2				REM	St2
				(n=8)	(8)				(12)	(12)
S2	5.77	1	.01	87.5	25	10.667	1	.0011	83.3	16.6
S4	4.98	1	.023	75	25	4.8	1	.0285	100	66.7
S1	0	1	1	62.5	62.5	0	1	1	75	75
S5	.201	1	.162	75	62.5	2.743	1	.0977	75	41.7
S3	2.286	1	.1306	100	75	0	1	1	91.7	91.7

* NOTE: Recallable experience at Post-test determined by subjects' phenomenological descriptions. Recallable experience across Training nights determined by response to Recall probe.

TABLE 8: Discrimination Performance Across Training Nights

a. All trials

<u>Subject</u>	<u>x2</u>	<u>df</u>	<u>p</u>	<u>kappa</u>	<u>df</u>	<u>p</u>	* <u>Correct</u> <u>REM</u>	<u>Stage</u>
All	10.848	1	.001	.48	1	.0086	61.9 (37/60)	68.3 (41/60)
S1	0	1	1	0	1	1	50	50
S2	1.6	1	.2059	.25	1	.1075	75	50
S3	2.743	1	.0977	.333	1	.0455	58.3	75
S4	8.224	1	.0041	.583	1	.0014	75	83.3
S5	3	1	.0833	.333	1	.0546	50	83.3

b. Recalls Only

S1	.234	1	.6287	.111	1	.305	66.7 (6/9)	44.4 (4/9)
S2	.48	1	.4884	.2	1	.2236	80 (8/10)	0 (0/2)
S3	2.933	1	.0268	.364	1	.0375	63.6 (7/11)	72.7 (8/11)
S4	4.848	1	.0277	.49	1	.0107	75 (9/12)	75 (6/8)
S5	2.8	1	.0943	.429	1	.0536	66.7 (6/9)	80 (4/5)

TABLE 9: -Frequency Counts of S2's Phenomenological Descriptions across Training nights

<u>Criteria</u>	a.		b.	
	<u>All</u> <u>REM</u> (n=12)	<u>Trials</u> <u>Stage 2</u> (12)	<u>Recalls Only</u> <u>REM</u> (10)	<u>Stage 2</u> (2)
Dreaming	10	1	7	1
No dreaming	2	9	0	0
Clear dream	1	0	1	0
Not in dreaming	1	0	1	0
Aroused	2	0	2	0
Eye movements	2	1	1	1
No eye movements	0	3	0	0
Couldn't open eyes	0	1	0	0
Not asleep	0	1	0	1
Didn't seem like a Stage 2	1	0	0	0
Don't know	1	1	0	0

TABLE 10: Frequency Counts of S4's Phenomenological Descriptions across Training nights

<u>Criteria</u>	<u>a.</u>		<u>b.</u>	
	<u>All</u> <u>REM</u> (n=12)	<u>Trials</u> <u>Stage 2</u> (12)	<u>Recalls</u> <u>REM</u> (12)	<u>Only</u> <u>Stage 2</u> (8)
Dreaming, storylike	11	7	11	7
Not dreaming	0	4	-	-
In it as a character, had a dream-body	4	0	4	0
No dream-body or character	1	3	1	3
Fairly involved with characters, physical activity	4	0	4	0
No involvement, detached, observing at best	2	4	2	4
Sensory experience eg. sight, sound	1	0	1	0
Lack of concrete or clear image	0	1	0	1
Very long, complex & continuous experience eg. plot; multiple scenes	4	0	4	0
Some complexity & detail	4	0	4	0
Very vivid & clear	5	0	5	0
Single scene	1	0	1	0
Other people	6	1	6	1
Color	5	0	5	0
Thoughts	0	1	0	1
Conversation	2	0	2	0
Awake	1	3	1	3

TABLE 11: Frequency Counts of S1's Phenomenological Descriptions across Training nights

<u>Criteria</u>	<u>a.</u>		<u>b.</u>	
	<u>All</u> <u>REM</u> <u>(n=12)</u>	<u>Trials</u> <u>Stage 2</u> <u>(12)</u>	<u>Recalls Only</u> <u>REM</u> <u>(9)</u>	<u>Stage 2</u> <u>(9)</u>
Dream	9	9	9	9
No recall	3	2	-	-
Hazy recall, trouble recalling	1	1	0	1
Personally involved, taking part, direct contact with characters, talk, feel, touch	2	2	2	2
Removed from events, not directly involved	1	3	1	3
Vivid, real, believable	3	1	3	1
Storylike, continuous, chronology, progression, predictable	4	0	4	0
Brief image	1	1	1	1
Fragmented experience	1	3	1	3
Deep sleep	0	1	0	0
Shallow sleep, awake	0	3	0	3
Unsatisfying sleep	0	1	0	1
Easy to wakeup	1	1	0	0

TABLE 12: Frequency Counts of S5's Phenomenological Descriptions
across Training nights

<u>Criteria</u>	a.		b.	
	<u>All</u> <u>REM</u> (n=12)	<u>Trials</u> <u>Stage 2</u> (12)	<u>Recalls Only</u> <u>REM</u> (9)	<u>Stage 2</u> (5)
Experience, dream	6	3	6	3
No dream	1	1	1	1
Involved physically, contact, participation, interaction with others	1	1	1	1
Little or no involvement or physical contact, detached observer	3	3	3	3
Auditory experience	1	0	1	0
Emotional & intense	4	1	4	1
No emotion	0	2	0	2
Continuous	2	0	2	0
Choppy	0	1	0	1
Alot of thinking	1	2	1	2
Little thinking	1	1	1	1
No dialogue	0	1	0	1
Little action	1	0	1	0
Awake	1	3	1	3
Not sure, guessed	3	5	1	5

TABLE 13: Frequency Counts of S3's Phenomenological Descriptions across Training nights

<u>Criteria</u>	a.		b.	
	<u>All</u> <u>REM</u> (n=12)	<u>Trials</u> <u>Stage 2</u> (12)	<u>Recalls</u> <u>REM</u> (11)	<u>Only</u> <u>Stage 2</u> (11)
Dreaming	10	9	10	9
Can't recall if anything	4	1	2	0
Participating actively	4	1	4	1
Observing, not involved much	1	4	1	4
Feelings, intense	3	1	3	1
Movement, conversation	2	0	2	0
Characters	1	1	1	1
Logical thinking	1	2	1	2
Eye movements	2	0	1	0
Spontaneous wakeup during dream	0	1	0	1
Awake, eg. aware of lab	0	4	0	4

TABLE 14: S2's Responses to Question-probes across Training nights

Probe	a.			b.		
	<u>All</u> <u>x2</u>	<u>Trials</u> <u>df</u>	<u>p</u>	<u>Recalls</u> <u>x2</u>	<u>Only</u> <u>df</u>	<u>p</u>
Directness of physical contact	4.2	4	.3796	.8	3	.8495
Clarity of sensory experience	11.905	4	.02	3.6	4	.4628
Feeling intensity	4.2	3	.2407	5.6	3	.1328
Time spent thinking	4.667	6	.5872	4.8	5	.4408
Complexity of experience	10.597	4	.0315	2.4	3	.4936
Number of human characters	12.267	6	.0563	4.8	3	.187
Number of scenes	4.59	3	.2044	.84	3	.8399
Sense of oneself	6.6	5	.2521	3.36	4	.4995
Complexity of color	2.182	2	.3359	.218	1	.6404
Depth of sleep	5.067	6	.5353	1.2	4	.8781
Sleep quality	.259	2	.8786	.426	2	.807
Continuity of experience	14.667	5	.01	7.2	4	.1257
Time spent observing passively	5.939	5	.3122	4.8	5	.4408
Time spent participating actively	9.905	6	.1287	5.6	3	.1328
Length of experience	11.778	4	.02	1.2	2	.5488
Vividness of sleep/dream world	13.6	5	.021	4.8	3	.187

TABLE 15: S4's Responses to Question-probes across Training nights

<u>Probe</u>	a.			b.		
	<u>All</u> <u>x2</u>	<u>Trials</u> <u>df</u>	<u>p</u>	<u>Recalls</u> <u>x2</u>	<u>Only</u> <u>df</u>	<u>p</u>
Directness of physical contact	17.6	6	.0073	13.333	6	.038
Clarity of sensory experience	14.333	6	.0261	9.931	5	.0772
Feeling intensity	15.667	6	.02	11.319	5	.0454
Time spent thinking	3.689	2	.1581	2.552	1	.1101
Complexity of experience	15.133	6	.02	10.764	5	.0563
Number of human characters	13.244	5	.0212	9.167	5	.1026
Number of scenes	14	6	.0296	9.583	5	.0879
Sense of oneself	16.8	6	.01	12.708	5	.0263
Complexity of color	17.333	6	.0081	13.056	6	.0422
Depth of sleep	7.333	6	.2911	5.556	5	.3519
Sleep quality	2.277	5	.8097	.764	3	.8097
Continuity of experience	13.333	6	.038	8.889	5	.1136
Time spent observing passively	11.2	5	.0476	11.667	5	.0397
Time spent participating actively	11.33	6	.0786	13.056	6	.0422
Length of experience	10.976	5	.0519	10.972	4	.0269
Vividness of sleep/dream world	15.333	6	.02	10.972	4	.0269

TABLE 16: S1's Responses to Question-probes across Training nights

<u>Probe</u>	a.			b.		
	<u>All</u> <u>x2</u>	<u>Trials</u> <u>df</u>	<u>p</u>	<u>Recalls</u> <u>x2</u>	<u>Only</u> <u>df</u>	<u>p</u>
Directness of physical contact	10.923	6	.0908	12.571	6	.0504
Clarity of sensory experience	9.143	6	.1657	10	6	.1247
Feeling intensity	5.758	6	.4509	7.333	6	.2911
Time spent thinking	2.444	5	.7848	2.533	4	.6387
Complexity of experience	14.333	6	.0261	16	6	.01
Number of human characters	5.486	5	.3595	7.333	5	.197
Number of scenes	9.2	6	.1626	8.533	6	.2010
Sense of oneself	4.644	5	.4608	4.867	5	.4324
Complexity of color	1.533	2	.4646	2	2	.3679
Depth of sleep	1.01	4	.9083	4.867	4	.3013
Sleep quality	3.533	6	.7395	4.533	6	.6049
Continuity of experience	5.619	6	.4672	5.619	5	.3451
Time spent observing passively	1.867	5	.8673	1.867	4	.7603
Time spent participating actively	3.676	5	.5969	2.476	4	.6489
Length of experience	6.019	6	.4211	3.486	3	.3226
Vividness of sleep/dream world	8.333	5	.1388	8.333	4	.0801

TABLE 17: S5's Responses to Question-probes across Training nights

<u>Probe</u>	<u>a.</u>			<u>Recalls Only</u>		
	<u>All</u> <u>x²</u>	<u>Trials</u> <u>df</u>	<u>p</u>	<u>x²</u>	<u>df</u>	<u>p</u>
Difectness of physical contact	6.316	3	.0972	4.321	3	.2288
Clarity of sensory experience	4.667	4	.3232	2.385	4	.6653
Feeling intensity	9.6	5	.0874	7.61	5	.179
Time spent thinking	5.091	5	.4049	7.83	5	.1659
Complexity of experience	8.978	5	.11	4.418	4	.3524
Number of human characters	9.692	6	.1382	8.919	6	.1782
Number of scenes	6.485	6	.3711	6.015	6	.4215
Sense of oneself	4.091	6	.6644	4.2	5	.521
Complexity of color	2.182	2	.3359	1.296	2	.523
Depth of sleep	7.533	6	.2743	3.837	5	.5731
Sleep quality	4	4	.406	2.966	3	.3969
Continuity of experience	5.933	6	.4307	3.474	5	.6273
Time spent observing passively	3.818	4	.4312	3.111	4	.5394
Time spent participating actively	5.086	5	.4055	5.071	5	.4073
Length of experience	9.933	6	.1275	7.83	5	.1659
Vividness of sleep/dream world	6.933	6	.3271	4.563	5	.4715

TABLE 18: S3's Responses to Question-probes across Training nights

<u>Probe</u>	a.			b.		
	<u>All</u> <u>x2</u>	<u>Trials</u> <u>df</u>	<u>p</u>	<u>Recalls</u> <u>x2</u>	<u>Only</u> <u>df</u>	<u>p</u>
Directness of physical contact	7.111	6	.3107	9.167	6	.1644
Clarity of sensory experience	17.8	6	.0068	16	5	.0068
Feeling intensity	4.419	5	.4908	2.8	4	.5918
Time spent thinking	1.167	3	.761	.944	3	.8147
Complexity of experience	9.4	6	.1523	8.2	5	.1456
Number of human characters	5.667	6	.4615	6.667	6	.3528
Number of scenes	13.5	5	.02	11.571	4	.02
Sense of oneself	6.905	4	.141	7.905	4	.0951
Complexity of color	11.778	6	.0671	11.778	6	.0671
Depth of sleep	6.9	4	.1413	7.033	4	.1341
Sleep quality	7.705	5	.1733	7.705	5	.1733
Continuity of experience	9.486	5	.0912	9.486	4	.05
Time spent observing passively	6.905	5	.2278	7.571	5	.1815
Time spent participating actively	8.667	6	.1932	8.667	5	.1231
Length of experience	6.61	5	.2513	6.61	4	.158
Vividness of sleep/dream world	7.571	4	.1086	7.571	3	.0558

TABLE 19: Embedded Figures Test and 'Differentiation Task' Data

<u>Subject</u>	<u>EFT Mean Score</u> (Std. dev.)	<u>Differentiation Score</u>	
		<u>REM</u>	<u>Stage 2</u>
S1	26.34 secs. (49.56)	6	3
S2	44.08 secs. (53.21)	6	5
S3	43.26 secs. (54.07)	3	1
S4	6.41 secs. (6.09)	6	2
S5	27.77 secs. (43.02)	6	3

Figure 1: S2 - Continuity of Experience

Figure 2: S4 - Physical Contact

Figure 3: S4 - Complexity of Color

Figure 4: S4 - Sense of Oneself

Figure 5: S1 - Complexity of Experience

Figure 6: S3 - Sensory Experience

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Figure 7: S3 - Sensory Experience

APPENDIX C
(Study #2)

TABLE 16: High recaller S4's responses to question-probes

Probes	a.			b.		
	All x2	Trials df	p	Recalls x2	Only df	p
Directness of physical contact	5.5	5	.3579	4.837	5	.436
Clarity of sensory experience	3.143	6	.7907	4.162	5	.5263
Feeling intensity	4.543	4	.3375	4.982	4	.2891
Time spent thinking	5.285	3	.1521	2.542	3	.4677
Complexity of experience	3.667	4	.453	4.297	4	.3672
Number of characters	3.4	4	.4932	2.34	4	.6735
Number of scenes	7.514	4	.1111	7.586	2	.0225
Sense of oneself	5.667	5	.34	5.995	5	.3067
Complexity of color	4.976	5	.4188	1.496	4	.8273
Depth of sleep	8.939	4	.0626	4.095	3	.2514
Sleep quality	4.267	4	.3711	2.147	4	.7087
Continuity of experience	4.61	5	.4654	3.632	5	.6035
Time spent observing passively	2.343	3	.5044	3.015	2	.2215
Time spent actively participating	5.476	5	.3606	3.295	4	.5098
Length of experience	6.371	4	.1731	4.944	4	.293
Vividness of sleep/dream world	8.133	5	.149	5.76	4	.2178
Self/nonself differentiation	14.857	4	.005	14.529	4	.0058
Recallability of experience	6.4	2	.0408	5.58	2	.0614
Permeability of sleep-wake boundary	6.4	3	.0937	5.58	2	.0614

Appendix C2: Follow-up Information*

You will sleep 4 consecutive nights in the laboratory. You will be told what is expected of you when you first come to the lab. The study will entail a number of awakenings per night. You must normally sleep between 7 and 8 hours regularly per night. Moreover, I'll ask you to abstain from all alcohol and drug consumption as well as atypical napping while you're participating in the study.

I'd like you to come to the lab for a tour and for the purposes of discussing what it is you'll be doing during the course of the study. Can we schedule such a meeting?

Appendix C3: The Description for All Nights

Each S reads this description before the hook-up.

This study was designed to investigate two types of sleep called Stage REM and Stage 2. I'd like to tell you a little bit about these sleep stages before I tell you what it is I'd like you to do tonight. Afterwards we will discuss this information. The following is intended to familiarize you a little bit with some of the interesting things known about the two types of sleep of concern in this study. This information is based on research procedures which did not rely on subjects' awareness of a REM/2 state difference, however. [Describe report-evaluation and probe techniques]

The two sleep stages of interest in this study are called Stage REM and Stage 2. Each is defined by patterns of: 1) brain electrical activity (EEG) measured via electrodes placed on the scalp; 2) eye movement activity (EOG) measured via electrodes affixed beside the eyes; and 3) changes in muscle tone (EMG) measured via electrodes attached under the chin.

Stage 2 (see Figure 1) is defined by the emergence of two EEG events which occur periodically against a background of the predominant brain electrical activity which is relatively low voltage, mixed frequency EEG. The two transient EEG events are: 1) brief bursts of fast-wave, low voltage spindle-like activity; and 2) high voltage spikes called K-complexes which are sharply rising and falling, high amplitude delta waves. These delta waves may comprise up to 20 percent of Stage 2 EEG. Finally, muscle tone is present while eye movements are typically absent.

Stage REM (see Figure 2) is defined by: 1) relatively low-voltage, mixed frequency EEG; 2) fast, conjugate eye movements; and 3) a loss of anti-gravity muscle tone. Consequently, Stages 2 and REM are most dissimilar in that only the former includes the 2 periodic EEG events called spindles and K-complexes while only the latter includes the abrupt, sharp eye movements as well as marked loss of muscle tone.

Ever since these two types of sleep stage were discovered, researchers have awakened subjects from these two stages and have then asked them to report any experiences that they may have had prior to, as well as during, the awakening. This research strategy has revealed a number of findings regarding the similarities and differences between the typical experiences associated with these two sleep states. A summary of these findings will be presented in a moment. But first, a note about some definitions pertinent to this study.

The attitude adopted in this study is that any experience occurring during sleep is called a sleep experience, providing you feel that it occurred during the pre-awakening sleep state. Furthermore, the experience of waking up may be described as involving the transition from the pre-awakening state and into the waking state. Consequently, in this study asking you to identify the type of sleep from which you were awakened amounts to asking whether you can identify, and distinguish between, two sleep states defined by experiential factors (eg. perceiving, acting, etc.) and that correspond to the two types of sleep stage

defined by EEG, EOG, and EMG patterns. That is, can you identify, and distinguish between, a Stage REM and Stage 2 sleep state using experience information?

Examples of sleep experience include visual experience which has typically defined the presence of 'dreaming'. However, dreaming defined in this way is only one kind of sleep experience. Seeing, hearing, acting, feeling, thinking, remembering, forgetting, imagining, etc., are all kinds of experience that may occur during sleep. These may happen in any combination or alone. Furthermore, experience while asleep can be experience-of 'something' such as a 'dream-world' (also called sleep-world) which may include people, objects or places.

On the other hand, experiences such as thinking or feeling can occur without the presence of a visually perceivable 'dream-world'. As well, experience can involve familiar or unfamiliar people, objects or places. In short, the attitude held in this study is that any kind of experience that may occur during waking can also occur during sleeping. Thus, the major difference between the two sets of experience is not what happens but rather the time of the experience in question: that is, whether it occurs during waking or sleeping.

The following is a summary of findings from the research literature regarding the similarities and differences between typical sleep and waking up experiences associated with the two sleep stages. One of the major findings reported in the literature is that the sleep experiences associated with the two types of sleep are often so similar in terms of the qualities to be described here that researchers and subjects alike cannot tell them apart. That is, many experiences obtained when subjects are awakened from Stages REM or Stage 2 are indistinguishable when evaluated in terms of these qualities. On the other hand, some differences have been reported.

For instance, awakenings from Stage REM are more often associated with a report of having had a dream (ie. visual/perceptual experience) during the pre-awakening state than are awakenings from Stage 2. However, the time of night that wakeups are performed may sometimes influence whether there will be a dream to report. 'Early in the night' refers to the first half of the night or so while 'later in the night' refers to the last half of the night or so. For example, for each of Stage REM and Stage 2, dream recall rates are higher later in the night than earlier in the night. Moreover, the likelihood of having a dream to report increases for Stage 2 as the night progresses so that the Stage 2 recall rate later in the night may reach a level similar to the REM recall rate early in the night.

When sleep experience is reported, typical REM experience tend to be more dreamlike than are typical Stage 2 experiences in the sense that the former are more likely to involve perceptual experience (eg. seeing). Nevertheless, perceptual experience does occur in Stage 2 and the likelihood of perceptual experience increases for both stages as the night progresses. Furthermore, Stage 2 experience late at night is similar to REM experience early in the night in that the experience is typically perceptual in nature. On the other hand, while thinking as an

activity during sleep does occur in both stages, it is reported to occur in both stages. However, experience that involves thinking as the sole activity, and unassociated with perceiving or acting, tends to occur more often in Stage 2 than in REM. In addition, experiences reported early in the night for both stages have tended to be more thought-like than are experiences reported later on in the night. Overall, however, perceptual and thinking experiences occur in both sleep states.

When dream experiences are reported by awakened subjects, those associated with Stage REM awakenings have typically been characterized by a greater involvement in the 'dream-world' on the part of the dreamer than for Stage 2 experiences. That is, the dreamer in Stage REM is more likely to actively participate in dream events, have direct physical contact with dream characters or objects, and experience or express feelings than in Stage 2 experiences. Furthermore, the overall activity level in Stage REM dreams exceeds that of Stage 2 dreams.

On the other hand, the dreamer in Stage 2 is more likely to have an experience of less involvement in that there is a passive observation of dream events (non-participatory involvement on the dreamer's part), less direct physical contact, and less of an emotional involvement. However, Stage 2, and REM experiences are often indistinguishable in that they exhibit more and less involvement, respectively, than is characteristic of their typical experiences. Finally, Stage 2 experience obtained late in the night is likely to be similar to Stage REM experience early in the night in terms of the dreamer's involvement; and, experiences from both stages often exhibit greater involvement on the dreamer's part as the night progresses.

REM experiences have been reported to last longer as well as involve a greater number of human characters and (dream) scene changes than do Stage 2 experiences. That is, REM experiences are elaborated to a greater extent than are Stage 2 experiences. However, Stage 2 and REM experiences are often indistinguishable in that they exhibit greater and lesser elaboration, respectively, than is characteristic of their typical experiences. In fact, Stage 2 experiences late in the night are often similar to REM experiences early in the night. Finally, experiences associated with both stages are elaborated to a lesser extent early in the night than later on in the night.

REM experiences are also more likely to exhibit the quality of, being a vivid, clear and continuous 'story' while Stage 2 experiences are less likely to show this quality. That is, these latter experiences are reported to be more fragmented and cut-up as well as less vivid and clear in nature. However, Stage REM and 2 experiences are often indistinguishable in that they exhibit lesser and greater continuity/clarity (or 'flow'), respectively, than is characteristic of their typical experiences. Some Stage 2 experiences late in the night are similar to REM experiences early in the night. Finally, experiences associated with both stages tend to be less continuous early in the night than later on in the night.

When subjects have been awakened from Stage REM they were likely to report having experienced pre-awakening sleep that was more relaxed and sound than when awakened from Stage 2. The

latter was more likely to have been characterized by a restless and agitated sleep. Furthermore, regardless of whether there was a sleep experience (eg. a dream) to report or not, subjects questioned upon arousal from Stage 2 reported on many occasions that they had felt they had been awake prior to being awakened by the researcher. Reports of having been awake prior to the wakeup were more likely to be associated with Stage 2 than REM while most arousals from REM yielded reports of having been asleep. However, reports of having been awake were also obtained following arousal from Stage REM.

In conclusion, despite some differences, experiences from both sleep states share considerable common ground and especially when time of night is taken into account. Consequently, some authors in the literature have suggested that subjects may have difficulty performing this discrimination task (cf. Foulkes, 1985). However, as yet there are not enough data to conclude that this task is or is not possible for subjects to succeed at. Therefore, this study was undertaken to address this issue.

It must be stressed that this researcher is uncertain as to whether anyone can perform this task successfully. Furthermore it must also be made clear that the description that you just read contains information which may or may not be useful to you in helping guide what it is that you will be asked to do in this study. The information may be no more useful than your own criteria. Therefore, use what works for you; this information, your own, or some combination of the two. Different individuals might use different criteria. Use whatever helps you in guiding your responses. You are not obliged to use this information.

Finally, your task for each of the four (4) nights involves the following. You will be awakened a number of times from each of these two types of sleep. and on each occasion you will be asked to tell me the type of sleep you feel you were in before I awakened you, Stage REM or Stage 2. That is, on each occasion you will be asked to identify the type of sleep from which you were awakened. You may use any criteria you wish in helping you to decide. Then, you will be asked to respond to a number of questions. Furthermore, you will be told whether your judgments are correct.

If you have any questions, then let us discuss them now. If not, I'd like to clarify some of the main points contained in this description.

[Once this has been completed, the E will say:] When you come to the lab to sleep, you can bring your own pillow if you wish. If not, we are fully equipped with pillows and bed-covers. Also, we have a shower and washroom facilities for your use and convenience. OK-- can we schedule you?

Appendix C4: The Self-Nonself Differentiation 'Probe'

The S will be taught to use Human Figure Drawings to rate their pre-awakening experience on each trial. The S is shown two sheets of paper, one which is blank and one with a Human Figure drawn on it (from Witkin et al, 1971). These two represent the extremes of a particular dimension called self-nonsel self differentiation.

The S will be told that these are the extremes, or endpoints defining a 7-point scale they will use to rate their pre-arousal sleep states. The S is told that the blank page represents the fact that during the sleep state there was: nothing to notice; no experience; no sense of oneself; no sense of 'nonself'; no sense of relation of the self to the nonself; and, no sense that self and nonself are clearly distinguishable. Moreover this blank page denotes a score of '1' on the self-nonsel self differentiation scale.

Then the other page is described to the S as reflecting: something to notice; an experience prior to awakening; a clear sense of self; a clear sense of 'nonself' (eg. other people, places, etc.); a clear sense of relation of self to the nonself; and, a sense that self and nonself are clearly distinguishable. Finally, the S is shown a number of other Human Figures used in the pilot study and in an order representing increasingly higher levels of self-nonsel self differentiation ranging between the two endpoints. He is told that these demonstrate increasingly clearer senses of the distinguishability of self and nonself.

The S is then told that if asked to rate a pre-arousal experience upon awakening, then he would "select the one that best captures how you felt in relation to whatever it is that you were experiencing". He will be reminded of the two endpoints and then he will select the one position on the scale that best reflects his sense of self-nonsel self differentiation.

The specific instructions to be asked are as follows: When I awaken you, at some point in time I'll ask you to rate how you felt in relation to your sleep-world before I called your name. I'd like you on each occasion to respond by selecting a score from 1 to 7, where 1 is 'no sense of myself or of a sleep-world' and 7 is 'a sense of myself being clearly distinguishable from the sleep-world'.

The S will then be asked whether he has any questions regarding what he is supposed to do.

Appendix C5: Schedule of Awakenings

A schedule for each of the 40 nights was drawn up in the following way. 'Couplets' of wakeups were generated, the first one determined by a coin flip, and the second one being the target stage other than the first one in the couplet. Four couplets constituted one night. Forty nights were generated and subjects were randomly assigned to groups of 4 randomly selected 'nights'.

Subject 1

<u>Night #1</u>	<u>#2</u>	<u>#3</u>	<u>#4</u>
2	2	2	REM
REM	REM	REM	2
REM	2	2	2
2	REM	REM	REM
REM	REM	REM	REM
2	2	2	2
REM	REM	2	2
2	2	REM	REM

Subject 2

2	REM	REM	2
REM	2	2	REM
REM	2	2	REM
2	REM	REM	2
2	REM	2	2
REM	2	REM	REM
REM	2	2	REM
2	REM	REM	2

Subject 3

REM	2	2	REM
2	REM	REM	2
REM	2	REM	2
2	REM	2	REM
REM	REM	REM	REM
2	2	2	2
2	REM	REM	2
REM	2	2	REM

Subject 4

REM	REM	2	2
2	2	REM	REM
2	REM	2	REM
REM	2	REM	2
REM	2	REM	REM
2	REM	2	2
2	2	2	REM
REM	REM	REM	2

Appendix C5-- continued..

Subject 5

<u>Night #1</u>	<u>#2</u>	<u>#3</u>	<u>#4</u>
REM	2	2	REM
2	REM	REM	2
2	REM	REM	2
REM	2	2	REM
REM	REM	REM	2
2	2	2	REM
REM	2	2	2
2	REM	REM	REM

Subject 6

REM	REM	2	2
2	2	REM	REM
2	REM	2	REM
REM	2	REM	2
2	2	2	REM
REM	REM	REM	2
2	2	2	REM
REM	REM	REM	2

Subject 7

REM	2	REM	2
2	REM	2	REM
REM	REM	2	2
2	2	REM	REM
REM	REM	2	REM
2	2	REM	2
REM	2	REM	REM
2	REM	2	2

Subject 8

2	REM	REM	REM
REM	2	2	2
2	2	2	2
REM	REM	REM	REM
REM	2	2	2
2	REM	REM	REM
REM	2	REM	2
2	REM	2	REM

Subject 9

2	2	REM	2
REM	REM	2	REM
REM	REM	2	REM
2	2	REM	2
2	2	REM	REM
REM	REM	2	2
REM	REM	REM	2
2	2	2	REM

Appendix C5-- continued..

Subject 10

REM	2	REM	REM
2	REM	2	2
2	2	2	REM
REM	REM	REM	2
REM	2	2	2
2	REM	REM	REM
REM	2	2	2
2	REM	REM	REM

Appendix C6: Inquiry

1. Where 1 is 'very tired' and 7 is 'very rested', how do you feel right now?
2. Where 1 is 'very poorly' and 7 is 'very well', how did you sleep last night?
3. Did you use a particular strategy to help you make your decisions about the stage from which you were awakened? If so, could you describe it?
4. What best describes the differences between experiences associated with these two sleep stages? The similarities?

Appendix C7: Final Inquiry

1. What are the clear-cut differences between experiences from Stages REM and 2?
2. What source of information, if any, influenced your performance in this study? What helped your strategy most? least?
3. Which were your best criteria for deciding which stage you were in?
4. Was there anything that made it difficult for you to succeed in identifying the stages from which you were awakened?

Appendix C8: Consent Form

CONSENT FORM

LABORATORY FOR THE STUDY OF SLEEP AND CHRONOPSYCHOLOGY

Description of Procedures:

Volunteers in this project are asked to spend four (4) consecutive nights sleeping in the Laboratory chamber. Before the volunteer goes to bed on each night the researcher will attach electrophysiological electrodes on the scalp and facial skin of the volunteer using electrically conductive electrode paste.

During the night the researcher will monitor the volunteer's brain activity, muscle tension and eye movements from the instrument room. The volunteer will be able to speak with the researcher by voice intercom during the night. A number of awakenings will be performed per night.

Agreement to participate:

I, _____, have read the
(volunteer's name)
above description and I agree to permit the researcher to carry out the required actions. I agree to hold them blameless for any inconveniences which my volunteering may cause me: eg. minor disruption of my normal sleep routines, etc. I agree that any data collected by the researcher during my time in the Sleep Laboratory may be used for scientific research and I understand that such data will not be publicly identified as my own-- confidentiality will be maintained to the greatest possible extent.

Date: _____

Signature: _____

Witness: _____

Appendix C9: Wakeup Protocol for All Nights.

1. [name], wake up, keep your eyes closed and remain as still as you possibly can.
2. Could you please tell me the type of sleep you were in before I called your name.
3. OK, now-- where 1 is 'not sure at all', 2 is 'pretty sure' and 3 is 'definite', how certain are you of your judgment?
4. What criteria did you use in making your decision? How did you go about deciding that you were in []?
5. [Experience probe]: Where 1 is 'yes' and 2 is 'no', did you have a sleep experience?
6. [Recallability probe]: Where 1 is 'definitely not', 2 is 'with some difficulty' and 3 is 'very easily', would you be able to report an experience if I asked you to do so?
7. Ask probes from Study #1 [same procedure] and the Differentiation probe.
8. [Feedback]: Yes, that was a [].. OR .. No, that wasn't a [].. it was a [].
9. Thanks alot-- you can go back to sleep now.

APPENDIX D
(Study #2)

TABLE 1: Discrimination Performance across Test nights

a. All Trials

<u>Subject</u>	<u>x²</u>	<u>df</u>	<u>p</u>	<u>kappa</u>	<u>df</u>	<u>p</u>	<u>% Correct</u> <u>REM</u>	<u>Stage 2</u>
<u>High Recallers:</u>								
All	11.379	1	.0007	.506	1	.0014	74.6 (44/59)	55.9 (33/59)
S4	2.667	1	.1025	.333	1	.0625	66.7 (n=12)	66.7 (n=12)
S6	.75	1	.3865	.167	1	.4722	75	41.7
S7	.259	1	.6109	.091	1	.5065	81.8 (n=11)	27.3 (n=11)
S8	.168	1	.682	.083	1	.533	58.3	50
S10	16.667	1	.0000	.833	1	.0002	91.7	91.7
<u>Low Recallers:</u>								
All	6.541	1	.01	.472	1	.009	60 (n=12)	63.3 (n=12)
S1	0	1	1	0	1	1	33.3	66.7
S2	.178	1	.6733	.083	1	.5124	58.3	33.3
S3	8.711	1	.0032	.583	1	.0018	66.7	91.7
S5	6	1	.02	.472	1	.017	75	75
S9	.686	1	.4076	.167	1	.4931	66.7	50

2
Test for Homogeneity of x tables for High and Low recaller groups: x² = .44, df = 1, p = .5076

TABLE 1--- continued...

b. Recalls Only

<u>Subject</u>	<u>x2</u>	<u>df</u>	<u>p</u>	<u>kappa</u>	<u>df</u>	<u>p</u>	<u>% Correct</u> <u>REM</u>	<u>Stage 2</u>
<u>High Recallers:</u>								
S4	1.8	1	.1797	.308	1	.0787	80 (n=10)	50 (n=8)
S6	(All 15 associated with 'REM' judgments)						100 (n=9)	0 (n=6)
S7	(All 16 associated with 'REM' judgments)						100 (n=9)	0 (n=7)
S8	.693	1	.4052	.174	1	.5467	77.8 (n=9)	40 (n=10)
S10	(All 12 associated with 'REM' judgments)						100 (n=11)	0 (n=1)
<u>Low Recallers:</u>								
S1	.11	1	.7401	.098	1	.69	50 (n=6)	60 (n=5)
S2	.014	1	.9056	.022	1	.8995	77.8 (n=9)	20 (n=10)
S3	7.987	1	.0047	.569	1	.0051	66.7 (n=12)	90.9 (n=11)
S5	(Only one recall)						(n=0)	(n=1)
S9	.714	1	.398	.129	1	.583	100 (n=11)	0 (n=1)

TABLE 2: Frequency Counts of Low recaller S1's Phenomenological Descriptions across Test nights

Criteria	a.		b.	
	All REM (n=12)	Trials Stage 2 (12)	Recalls Only REM (6)	Stage 2 (5)
Dreaming	0	1	0	1
No. experience	3	3	-	-
Vivid, sensory experience	2	0	2	0
Physical involvement with objects	1	0	1	0
Interaction with others	2	1	2	1
Difficulty recalling experience	1	0	1	0
Thinking	4	3	2	3
Deep, relaxed sleep	3	1	3	1
Awake	2	5	2	3
Guessed	1	1	0	0

TABLE 3: Frequency Counts of Low recaller S2's Phenomenological Descriptions across Test nights

<u>Criteria</u>	a.		b.	
	<u>All</u> <u>REM</u> (n=12)	<u>Trials</u> <u>Stage 2</u> (12)	<u>Recalls Only</u> <u>REM</u> (9)	<u>Stage 2</u> (10)
Visual experience	6	8	6	8
No visual experience	2	2	0	0
Could see myself in the dream	1	0	1	0
Directly involved	0	1	0	1
Thinking	4	2	4	2

TABLE 4: Frequency Counts of Low recaller S3's Phenomenological Descriptions across Test nights

<u>Criteria</u>	a.		b.	
	<u>All</u> <u>REM</u> (n=12)	<u>Trials</u> <u>Stage 2</u> (12)	<u>Recalls Only</u> <u>REM</u> (12)	<u>Stage 2</u> (11)
No dreaming	0	1	-	-
Involved in action eg. interacting with people	7	3	7	3
Watching self in action	1	0	1	0
Not too involved, looking on from outside	1	5	1	5
Trouble recalling experience	5	1	5	1
Forget experience when woke up	0	5	0	5
Woke up easily	4	0	4	0
Not asleep	0	1	0	1

TABLE 5: Frequency Counts of High recaller S4's Phenomenological Descriptions across Test nights

<u>Criteria</u>	<u>a.</u>		<u>b.</u>	
	<u>All</u> <u>REM</u> (n=12)	<u>Trials</u> <u>Stage 2</u> (12)	<u>Recalls Only</u> <u>REM</u> (10)	<u>Stage 2</u> (8)
Involved, in sleep-experience, participating	3	0	3	0
Not involved, just watching	0	1	0	1
Very vivid, definite, solid images	4	2	4	2
Not vivid, less definite images	1	1	0	1
Sound, vivid feeling	1	0	1	0
Didn't feel much	1	0	0	0
Long, continuous experience	6	3	6	3
Choppy experience	1	2	1	2
Clear experience	3	2	3	2
Alot happening	2	0	2	0
Short experience	2	1	1	1
Recall little	1	1	1	1
Took time to wakeup	1	0	1	0
Deep sleep	5	3	5	2
Shallow sleep	3	4	3	4

TABLE 6: Frequency Counts of Low recaller S5's Phenomenological Descriptions across Test nights

<u>Criteria</u>	a.		b.	
	<u>All</u> <u>REM</u> (n=12)	<u>Trials</u> <u>Stage 2</u> (12)	<u>Recalls Only</u> <u>REM</u> (0)	<u>Stage 2</u> (1)
Totally asleep	5	2	0	1
Not asleep	3	3	0	1
Tired	1	1	0	1
Responded quickly to wakeup call	1	2	0	1
Eyes pulsating	0	1	0	0
Guess	1	1	0	0

TABLE 7: Frequency Counts of High recaller S6's Phenomenological Descriptions across Test nights

<u>Criteria</u>	a.		b.	
	<u>All</u> <u>REM</u> (n=12)	<u>Trials</u> <u>Stage 2</u> (12)	<u>Recalls Only</u> <u>REM</u> (9)	<u>Stage 2</u> (6)
Dreaming	9	6	9	5
No dreaming	4	3	-	-
Visual scenes	1	0	1	0
Guess	0	1	0	0

TABLE 8: Frequency Counts of High recaller S7's Phenomenological Descriptions across Test nights

<u>Criteria</u>	a.		b.	
	<u>All</u> <u>REM</u> (n=11)	<u>Trials</u> <u>Stage 2</u> (11)	<u>Recalls Only</u> <u>REM</u> (9)	<u>Stage 2</u> (7)
Dreaming	6	6	6	6
No dreaming	2	2	2	2
Vivid dreaming	3	1	3	1
Thinking	0	1	0	0
Not asleep	0	1	0	0

TABLE 9: Frequency Counts of High recaller S8's Phenomenological Descriptions across Test nights

<u>Criteria</u>	a.		b.	
	<u>All</u> <u>REM</u> (n=12)	<u>Trials</u> <u>Stage 2</u> (12)	<u>Recalls Only</u> <u>REM</u> (9)	<u>Stage 2</u> (10)
Dreaming	4	6	4	6
No dreaming	4	3	-	-
Deep dream= intense, vivid & real	4	2	4	2
Less vivid dreaming	0	1	0	1
Can't recall dream easily	0	1	0	1
Deep, sound sleep	4	3	4	2
Not completely asleep	0	1	0	1

TABLE 10: Frequency Counts of Low recaller S9's Phenomenological Descriptions across Test nights

<u>Criteria</u>	a.		b.	
	<u>All</u> <u>REM</u> (n=12)	<u>Trials</u> <u>Stage 2</u> (12)	<u>Recalls Only</u> <u>REM</u> (9)	<u>Stage 2</u> (6)
Dreaming	7	6	7	6
No dreaming	1	0	0	0
Asleep	1	0	0	0
Awake	3	5	0	1

TABLE 11: Frequency Counts of High recaller S10's Phenomenological Descriptions across Test nights

Criteria	a.		b.	
	All REM (n=12)	Trials Stage 2 (12)	Recalls Only REM (11)	Stage 2 (1)
Dreaming	10	1	10	1
Not dreaming	1	10	-	-
present in dream	2	0	2	0
real	4	0	4	0
clear experience	5	1	5	1
unclear experience	0	1	0	1
visual experience	4	0	4	0
No visual experience	0	3	0	0
Conversation	1	0	1	0

TABLE 12: Incidence of Sleep Experience across Test nights*

Subject	χ^2	df	p	% Recall	
				REM	Stage 2
All High recallers	9.937	1	.0016	80	53.3
All Low recallers	.307	1	.5796	60	55
S1	.168	1	.682	50	41.7
S2	.253	1	.6152	75	83.3
S3	1.043	1	.307	100	91.7
S4	.889	1	.3458	83.3	66.7
S5	1.043	1	.307	0	8.3
S6	1.6	1	.2059	75	50
S7	.917	1	.3384	81.8	63.6
S8	.253	1	.6152	75	83.3
S9	1.6	1	.2059	75	50
S10	16.667	1	.0000	91.7	8.3

Test of Homogeneity of χ^2 for the two recaller groups:
 $\chi^2 = 3.81$ $df = 1$ $p = .051$

* NOTE: Sleep experience determined by response to Experience probe.

TABLE 13: Low recaller S1's responses to question-probes

Probes	a.			b.		
	All x2	Trials df	p	Recalls x2	Only df	p
Directness of physical contact	1.4	2	.4966	2.261	2	.3229
Clarity of sensory experience	0	2	1	1.589	2	.4518
Feeling intensity	6.267	3	.0993	3.135	2	.2086
Time spent thinking	.476	4	.9758	3.471	4	.4823
Complexity of experience	2.182	3	.5355	2.396	1	.1217
Number of characters	2.286	2	.3189	1.397	2	.4974
Number of scenes	4.835	3	.1843	3.74	2	.1541
Sense of oneself	5.333	4	.2548	5.238	2	.0729
Complexity of color	8.416	3	.0382	6.967	3	.070*
Depth of sleep	3.587	5	.6102	3.471	4	.482
Sleep quality	6.444	4	.1683	3.471	3	.3245
Continuity of experience	.476	2	.7881	2.261	2	.3229
Time spent observing passively	3.692	4	.4492	3.068	3	.3813
Time spent actively participating	6.961	5	.2236	2.261	3	.52
Length of experience	2.808	2	.2462	2.933	2	.2307
Vividness of sleep/dream world	.21	2	.9005	.052	1	.819
Self/nonself differentiation	7.806	3	.0502	11	3	.02
Recallability of experience	4.286	2	.1173	5.238	2	.0729
Permeability of sleep-wake boundary	9.238	4	.0554	5.238	2	.0729

TABLE 14: Low 'recaller S2's responses to question-probes

Probes	a.			b.		
	All x2	Trials df	p	Recalls x2	Only df	p
Directness of physical contact	9.167	5	.1026	6.737	5	.2409
Clarity of sensory experience	4.218	5	.5184	5.229	5	.3886
Feeling intensity	3.486	5	.6256	2.822	5	.7274
Time spent thinking	.889	1	.3458	.014	1	.9056
Complexity of experience	1.591	3	.6615	1.396	3	.7065
Number of characters	3.833	5	.5737	2.788	4	.5938
Number of scenes	.933	4	.9197	2.908	4	.5734
Sense of oneself	9.952	4	.0412	10.978	4	.0268
Complexity of color	3.152	4	.5328	3.72	4	.4453
Depth of sleep	4.4	4	.3546	6.012	4	.1983
Sleep quality	5.476	3	.1401	4.603	3	.2033
Continuity of experience	3.733	4	.4433	2.064	3	.5592
Time spent observing passively	3.059	4	.548	3.29	4	.5105
Time spent actively participating	2.619	5	.7585	3.29	5	.6554
Length of experience	1.2	3	.753	2.03	3	.5662
Vividness of sleep/dream world	2.867	4	.5804	3.457	4	.4845
Self/nonself differentiation	3.363	4	.4991	4.852	4	.3029
Recallability of experience	5.056	2	.0798	4.866	2	.0878
Permeability of sleep-wake boundary	5.105	3	.1643	4.866	2	.0878

TABLE 15: Low recaller S3's responses to question-probes

Probes	a.			b.		
	All x ²	Trials df	p	Recalls x ²	Only df	p
Directness of physical contact	9.133	5	.1039	8.105	5	.1505
Clarity of sensory experience	4.967	5	.42	3.931	4	.4155
Feeling intensity	2.819	4	.3074	1.779	3	.6195
Time spent thinking	4.81	4	.3074	4.632	4	.3272
Complexity of experience	5.833	5	.3228	4.799	4	.3086
Number of characters	6.571	5	.2545	5.538	4	.2364
Number of scenes	2.1	3	.5519	1.86	3	.602
Sense of oneself	1.227	3	.7346	.568	3	.9038
Complexity of color	2.167	3	.5385	1.125	2	.5697
Depth of sleep	4.4	6	.6227	3.363	5	.6442
Sleep quality	4.286	5	.5091	3.248	4	.5172
Continuity of experience	7.867	4	.0966	6.836	3	.0773
Time spent observing passively	3.01	6	.8077	4.641	6	.5905
Time spent actively participating	14.371	5	.01	13.353	5	.0203
Length of experience	4.4	5	.4934	3.363	4	.499
Vividness of sleep/dream world	3.644	5	.6017	2.606	4	.6258
Self/nonself differentiation	3.833	4	.429	2.795	4	.5927
Recallability of experience	2.492	2	.2876	2.094	2	.351
Permeability of sleep-wake boundary	3.133	3	.3715	2.094	2	.351

TABLE 16: High recaller S4's responses to question-probes

Probes	a.			b.		
	<u>All</u> <u>x2</u>	<u>Trials</u> <u>df</u>	<u>p</u>	<u>Recalls</u> <u>x2</u>	<u>Only</u> <u>df</u>	<u>p</u>
Directness of physical contact	5.5	5	.3579	4.837	5	.436
Clarity of sensory experience	3.143	6	.7907	4.162	5	.5263
Feeling intensity	4.543	4	.3375	4.982	4	.2891
Time spent thinking	5.285	3	.1521	2.542	3	.4677
Complexity of experience	3.667	4	.453	4.297	4	.3672
Number of characters	3.4	4	.4932	2.34	4	.6735
Number of scenes	7.514	4	.1111	7.586	2	.0225
Sense of oneself	5.667	5	.34	5.995	5	.3067
Complexity of color	4.976	5	.4188	1.496	4	.8273
Depth of sleep	8.939	4	.0626	4.095	3	.2514
Sleep quality	4.267	4	.3711	2.147	4	.7087
Continuity of experience	4.61	5	.4654	3.632	5	.6035
Time spent observing passively	2.343	3	.5044	3.015	2	.2215
Time spent actively participating	5.476	5	.3606	3.295	4	.5098
Length of experience	6.371	4	.1731	4.944	4	.293
Vividness of sleep/dream world	8.133	5	.149	5.76	4	.2178
Self/nonself differentiation	14.857	4	.005	14.529	4	.0058
Recallability of experience	6.4	2	.0408	5.58	2	.0614
Permeability of sleep-wake boundary	6.4	3	.0937	5.58	2	.0614

TABLE 17: Low recaller S5's responses to question-probes

<u>Probes</u>	a.			b.		
	<u>All</u> <u>x2</u>	<u>Trials</u> <u>df</u>	<u>p</u>	<u>Recalls</u> <u>x2</u>	<u>Only</u> <u>df</u>	<u>p</u>
Directness of physical contact	2	3	.5724	ONLY ONE (STAGE 2) OBSERVATION.		
Clarity of sensory experience	1.048	2	.5923			
Feeling intensity	2.182	2	.3359			
Time spent thinking	4	3	.2615			
Complexity of experience	1.043	1	.307			
Number of characters	3.048	3	.3843			
Number of scenes	3.048	2	.2179			
Sense of oneself	6	6	.4232			
Complexity of color	1.048	2	.5923			
Depth of sleep	10.867	6	.0926			
Sleep quality	6.4	6	.3799			
Continuity of experience	4.667	5	.4579			
Time spent observing passively	2.933	4	.569			
Time spent actively participating	.381	1	.5371			
Length of experience	3.048	3	.3843			
Vividness of sleep/dream world	1.043	1	.307			
Self/nonself differentiation	5.911	5	.315			
Recallability of experience	1.818	2	.4029			
Permeability of sleep-wake boundary	3.818	3	.2818			

TABLE 18: High recaller S6's responses to question-probes

Probes	a.			b.		
	All x2	Trials df	p	Recalls x2	Only df	p
Directness of physical contact	8.923	6	.178	7.708	6	.2603
Clarity of sensory experience	5.6	5	.3471	4.583	5	.4688
Feeling intensity	3.6	4	.4628	2.5	4	.6446
Time spent thinking	5	6	.5438	4.583	5	.4688
Complexity of experience	5.619	6	.4672	3.056	4	.5486
Number of characters	4.619	5	.4641	4.097	5	.5355
Number of scenes	9.905	6	.1287	10.139	6	.1189
Sense of oneself	8.133	6	.2285	7.5	6	.2771
Complexity of color	5.818	4	.2131	4.394	3	.2219
Depth of sleep	8	6	.2381	3.889	6	.6917
Sleep quality	5.091	5	.4049	5.583	4	.3328
Continuity of experience	5	6	.5438	4.583	5	.4688
Time spent observing passively	8.286	5	.1412	9.444	5	.0926
Time spent actively participating	3.667	5	.5983	2.5	5	.7765
Length of experience	3.033	5	.6948	3.056	5	.6914
Vividness of sleep/dream world	8.333	6	.2147	9.097	6	.1682
Self/nonself differentiation	7.778	6	.2548	7.361	6	.2887
Recallability of experience	1.202	2	.5483	1.667	2	.4346
Permeability of sleep-wake boundary	8.2	5	.1456	1.667	2	.4346

TABLE 19: High recaller S7's responses to question-probes

Probes	a.			b.		
	<u>All</u> <u>x2</u>	<u>Trials</u> <u>df</u>	<u>p</u>	<u>Recalls</u> <u>x2</u>	<u>Only</u> <u>df</u>	<u>p</u>
Directness of physical contact	13	6	.043	12.952	5	.0238
Clarity of sensory experience	16	4	.003	16	3	.0011
Feeling intensity	15.667	6	.02	12.952	6	.0438
Time spent thinking	5.619	6	.4672	4.158	5	.5269
Complexity of experience	13.333	6	.038	11.937	5	.0357
Number of characters	9.667	6	.1394	7.196	5	.2065
Number of scenes	5.2	4	.2674	7.641	3	.054
Sense of oneself	11.943	6	.0633	6.325	5	.2759
Complexity of color	13.133	6	.041	11.259	6	.0807
Depth of sleep	6.733	6	.3462	10.582	5	.0603
Sleep quality	14	5	.02	9.228	5	.1003
Continuity of experience	10.286	6	.1131	6.654	3	.0838
Time spent observing passively	5.667	6	.4615	5.299	5	.3804
Time spent actively participating	10	6	.1247	7.196	5	.2065
Length of experience	12.3	5	.0309	9.194	3	.0268
Vividness of sleep/dream world	11.533	6	.0732	8.076	4	.0888
Self/nonself differentiation	12.571	5	.0277	10.582	4	.0317
Recallability of experience	1.222	1	.2689	2.939	1	.0865
Permeability of sleep-wake boundary	4.143	3	.2464	2.939	1	.0865

TABLE 20: High recaller S8's responses to question-probes

Probes	a.			b.		
	<u>All</u> <u>x2</u>	<u>Trials,</u> <u>df</u>	<u>p</u>	<u>Recalls</u> <u>x2</u>	<u>Only</u> <u>df</u>	<u>p</u>
Directness of physical contact	6.533	6	.3662	7.903	6	.2453
Clarity of sensory experience	5.41	5	.368	5.229	5	.3886
Feeling intensity	1.676	5	.8919	3.089	5	.6862
Time spent thinking	2.952	5	.7073	1.638	3	.6509
Complexity of experience	7.819	5	.1665	5.582	5	.3491
Number of characters	1.444	5	.9194	2.755	5	.7377
Number of scenes	4.8	4	.3084	5.095	4	.2777
Sense of oneself	5.744	4	.2191	6.699	4	.1527
Complexity of color	6.886	4	.1421	5.462	4	.243
Depth of sleep	11.6	5	.0407	10.577	5	.0605
Sleep quality	8.818	5	.1165	5.073	4	.2799
Continuity of experience	3.086	3	.3786	4.961	3	.1747
Time spent observing passively	3.152	5	.6765	1.619	5	.899
Time spent actively participating	4.667	5	.4579	5.63	5	.3439
Length of experience	10.8	5	.0555	10.777	5	.056
Vividness of sleep/dream world	4.667	5	.4579	4.961	5	.4206
Self/nonself differentiation	3.486	5	.6256	1.953	4	.7444
Recallability of experience	8.416	2	.01	10.248	2	.006
Permeability of sleep-wake boundary	10.473	3	.01	10.248	2	.006

TABLE 21: Low recaller S9's responses to question-probes

Probes	a.			b.		
	<u>All</u> <u>x2</u>	<u>Trials</u> <u>df</u> p		<u>Recalls</u> <u>x2</u>	<u>Only</u> <u>df</u> p	
Directness of physical contact	4.4	6 .6227		4.583	6 .5982	
Clarity of sensory experience	.933	4 .9197		.972	4 .914	
Feeling intensity	7	5 .2206		6.875	5 .2301	
Time spent thinking	3.3	5 .6538		1.458	4 .834	
Complexity of experience	4.067	4 .3971		4.236	4 .375	
Number of characters	1.067	4 .8995		1.111	4 .8925	
Number of scenes	4.233	4 .3753		4.41	4 .3534	
Sense of oneself	6.2	6 .4012		5.278	3 .1526	
Complexity of color	5.067	4 .2805		5.278	4 .26	
Depth of sleep	10.3	5 .0672		7.857	3 .0491	
Sleep quality	6	5 .3062		.417	3 .9368	
Continuity of experience	4.4	6 .6227		1.111	4 .8925	
Time spent observing passively	8.178	4 .0853		8.519	4 .0743	
Time spent actively participating	2.958	4 .5649		4.444	4 .3492	
Length of experience	1.067	4 .8995		1.111	4 .8925	
Vividness of sleep/dream world	2.9	4 .5747		3.021	4 .5543	
Self/nonself differentiation	7.467	6 .2798		2.639	5 .7554	
Recallability of experience	2.092	2 .3513		.833	2 .6592	
Permeability of sleep-wake boundary	2.4	3 .4936		.833	2 .6592	

TABLE 22: High recaller S10's responses to question-probes

Probes	a.			b.		
	<u>All</u> <u>x2</u>	<u>Trials</u> <u>df</u>	<u>p</u>	<u>Recalls</u> <u>x2</u>	<u>Only</u> <u>df</u>	<u>p</u>
Directness of physical contact	13.067	5	.0228	3.273	4	.5133
Clarity of sensory experience	14.3	5	.0138	2.182	4	.7024
Feeling intensity	15.444	5	.0086	5.455	4	.2438
Time spent thinking	11.833	6	.0658	5.455	4	.2438
Complexity of experience	15.778	6	.02	5.455	4	.2438
Number of characters	13.033	6	.0425	3.273	4	.5133
Number of scenes	16.533	5	.0055	3.273	4	.5133
Sense of oneself	12.578	5	.0277	1.527	4	.8218
Complexity of color	10.311	6	.1121	2.182	4	.7024
Depth of sleep	14.705	5	.02	5.455	4	.2438
Sleep quality	11.6	5	.0407	5.455	4	.2438
Continuity of experience	15	6	.0203	2.182	4	.7024
Time spent observing passively	15	6	.0407	12	4	.0174
Time spent actively participating	17.333	5	.0039	12	4	.0174
Length of experience	18.333	6	.0055	3.273	4	.5133
Vividness of sleep/dream world	18.667	6	.0048	5.455	4	.2438
Self/nonself differentiation	15.111	5	.0099	12	4	.0174
Recallability of experience	17.133	2	.0002	1.527	1	.2165
Permeability of sleep-wake boundary	17.133	2	.0002	1.527	1	.2165

TABLE 23: Questionnaire, Test and Additional Nighttime Data

Subject	Embedded Figures (std devn.)	Private Self- Consciousness	Fatigue (mean)	Sleep quality (mean)
S1(Low)	17.28 (19.5)	24 (/40)	4.33	4.33
S2(Low)	11.64 (12.2)	23	5	5
S3(Low)	4.13 (3.42)	25	3.33	4
S4(High)	3.19 (1.93)	29	3.67	4
S5(Low)	28.66 (21.92)	23	5.67	6
S6(High)	4.28 (1.83)	31	4	6
S7(High)	9.46 (5.01)	26	4.33	3.33
S8(High)	4.61 (3.7)	19	3	5
S9(Low)	8.36 (5.51)	21	5	5.67
S10(High)	3.7 (2.1)	27	6.67	6

Means:

Hights	5.048 (SD= 2.3)	26.4 (4.08)	4.33 (1.3)	4.87 (1.07)
Lows	14.014 (SD= 8.5)	23.2 (1.33)	4.67 (.79)	5 (.76)

High vs. Low Recaller contrasts*:

Embedded Figures Test $t(1,8) = 2.04$, $p = .0756$

Private Self-consciousness $t(1,8) = 1.49$, $p = .174$

Fatigue $t(1,8) = .45$, $p = .6651$

Sleep quality $t(1,8) = .2$, $p = .8432$

* All t-tests two-tailed

TABLE 24: Exploratory Data reflecting the Openness or Permeability of the Sleep-wake Boundary

	<u>% Lab Recall</u>			<u># Contentless</u>			<u># Moderately Facilitative</u>			<u># Very Facilitative</u>		
	<u>Total</u> (n=24)	<u>REM</u> (12)	<u>St2</u> (12)	<u>Total</u>	<u>REM</u>	<u>St2</u>	<u>Total</u>	<u>REM</u>	<u>St2</u>	<u>Total</u>	<u>REM</u>	<u>St2</u>
<u>High Recallers</u>												
S4	75	83.3	66.7	3	1	2	10	4	6	5	5	
S6	62.5	75	50	2	1	1	5	2	3	8	6	
S7	66.7	75	58.3	2	0	2	14	9	5	0	0	
S8	79.2	75	83.3	2	0	2	11	3	8	6	6	
S10	50	91.7	4.2	0	0	0	5	4	1	7	7	

Low Recallers

S1	45.8	50	41.7	1	1	0	7	2	5	3	3	
S2	79.2	75	83.3	6	4	2	7	1	6	6	4	
S3	95.8	100	91.7	12	5	7	6	3	3	5	4	
S5	4.2	0	8.3	0	0	0	1	0	1	0	0	
S9	62.5	75	50	4	2	2	10	6	4	1	1	

Group Totals

High Recallers:

Mean=	66.7	80	53.3	1.8	.4	1.4	9	4.4	4.6	5.2	4.8	.4
SD=	10.2	6.68	24.2	.98	.49	.8	3.5	2.4	2.4	2.8	2.5	.8

Low Recallers (with S5):

Mean=	57.5	60	55	4.6	2.4	2.2	6.2	2.4	3.8	3.0	2.4	.6
SD=	31.4	33.9	30.1	4.3	1.9	2.6	2.9	2.1	1.7	2.3	1.6	.8

Low Recallers (without S5):

Mean=	70.8	75	66.7	5.8	3.0	2.8	7.5	3.0	4.5	3.8	3.0	.8
SD=	18.6	17.7	21.2	4.0	1.6	2.6	1.5	1.9	1.1	1.9	1.2	.8

Figure 1: S4 - Differentiation

Figure 2: S4 - Differentiation

Figure 3: S7 - Sensory Experience

Figure 4: S7 - Sensory Experience

Figure 5: S8 - Recallability

Figure 6: S8 - Boundary Permeability

Figure 7: S8 - Recallability

Figure 8: S8 - Boundary Permeability

Figure 9: S10 - Feeling Intensity

Figure 10: S10 - Number of Scenes

Figure 11: S10 - Active Participation

Figure 12: S10 - Length of Experience

Figure 13: S10 - Vividness

Figure 14: S10 - Differentiation

Figure 15: S10 - Recallability

Figure 16: S10 - Boundary Permeability

Figure 17: S3 - Active Participation

APPENDIX E
(Study #2)

SELF-CONSCIOUSNESS SCALE

Please rate each of the following items on a scale from zero to four, where zero indicates that the item is extremely uncharacteristic of you, and four indicates that the item is extremely characteristic of you. Please be sure to answer all items by circling the appropriate number.

1. I'm always trying to figure myself out.	0	1	2	3	4
2. I'm concerned about my style of doing things.	0	1	2	3	4
3. Generally, I'm not very aware of myself.	0	1	2	3	4
4. It takes me time to overcome my shyness in new situations.	0	1	2	3	4
5. I reflect about myself alot.	0	1	2	3	4
6. I'm concerned about the way I present myself.	0	1	2	3	4
7. I'm often the subject of my own fantasies.	0	1	2	3	4
8. I have trouble working when someone is watching me.	0	1	2	3	4
9. I never scrutinize myself.	0	1	2	3	4
10. I get embarrassed very easily.	0	1	2	3	4
11. I'm self-conscious about the way I look.	0	1	2	3	4
12. I don't find it hard to talk to strangers.	0	1	2	3	4
13. I'm generally attentive to my inner feelings.	0	1	2	3	4
14. I usually worry about making a good impression.	0	1	2	3	4
15. I'm constantly examining my motives.	0	1	2	3	4
16. I feel anxious when I speak in front of a group.	0	1	2	3	4
17. One of the last things I do before I leave the house is look in the mirror.	0	1	2	3	4
18. I sometimes have the feeling that I'm off somewhere watching myself.	0	1	2	3	4
19. I'm concerned about what other people think of me.	0	1	2	3	4

10. I'm alert to changes in my mood.	0	1	2	3	4
11. I'm usually aware of my appearance.	0	1	2	3	4
12. I'm aware of the way my mind works
when I work through a problem.	0	1	2	3	4
13. Large groups make me nervous.	0	1	2	3	4

END

20.06.88

FIN