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**The effects of differential sleep stage deprivation on daytime  
sleep onset and REM period mentation**

**Carroll, Paul MacGregor, Ph.D.**

City University of New York, 1994

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A

The Effects of Differential Sleep Stage Deprivation on  
Daytime Sleep Onset and REM Period Mentation

by

Paul M. Carroll

A dissertation submitted to the Graduate Faculty  
in Psychology in partial fulfillment of the  
requirements for the degree of Doctor of  
Philosophy, The City University of New York.

1994

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This manuscript has been read and accepted for the Graduate Faculty in Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

12/14/93                      Steven Ellman  
Date                                      Chair of Examining Committee

12/14/93                      Kay Deaux  
Date                                      Executive Officer

Laurence J. Gould, Ph.D.

Michael Moskowitz, Ph.D.

Supervisory Committee

The City University of New York

**Abstract****The Effects of Differential Sleep Stage Deprivation on  
Daytime Sleep Onset and REM Period Mentation**

by

Paul M. Carroll

Adviser: Professor Steven J. Ellman

This dissertation reports on an experimental sleep mentation study which examined the effects of deprivation of Rapid Eye Movement sleep and Stage 2 sleep on both nocturnal REM mentation and Daytime Sleep Onset mentation. An attempt was made to replicate findings with the Absorption in Mentation Scales (Weinstein, Schwartz & Ellman, 1988; 1991). In prior studies several subscales of the AIMS had shown sensitivity in discriminating conditions of greater phasic activity during various stages of nocturnal sleep. For the present study two sets of planned, orthogonal contrasts were devised based on prior findings. These contrasts were intended to address two issues; (1) Is there greater suspension of self reflective self-representation in mentation from nocturnal REM periods following REM deprivation, (an attempt to replicate prior findings with the AIMS); (2) Is there a greater suspension of self

reflective self-representation in Daytime Sleep Onset mentation following REM deprivation. Several other scales were included in the study. Foulkes "dreamlike fantasy" scale (DF) and Molinari & Foulkes Sensory scale were included to compare with the prior studies using the AIMS. Additionally, two subscales of the Psycholinguistic Coding Manual (Antrobus et al., 1977) were included to address quantitative differences. These were the Total Content Count and the Self Participation subscales.

Sixteen subjects contributed 234 mentation reports in two days and three nights in the sleep laboratory. The reports were rated by three judges blind to awakening conditions. Intraclass correlation coefficients were calculated to establish interrater reliabilities. Thirteen scales were subjected to repeated measures analysis which provided the mean squares values for the planned contrasts and post hoc comparisons. The overwhelming outcomes of these comparisons were not significant leading to the conclusion that the Daytime Sleep Onset mentation does not show a greater suspension of reflective self-representation following REM deprivation. Furthermore, the attempts to replicate the findings of Weinstein, Schwartz & Ellman were unsuccessful. However, methodological difficulties prevent strong generalizations from being drawn about the validity of the present study as an adequate replication of these studies. Two sets of post hoc analyses were conducted. One

post hoc analysis examined nocturnal reports alone and compared first and second nights of deprivation; a comparison was also made of recovery nights between REM and Stage 2 deprived subjects. No significant findings were obtained for these comparisons. A second set of post hoc comparisons were made in which Daytime Sleep Onset mentation was compared to Nocturnal REM period mentation with significant findings on several of the AIM scales and the Self Participation subscale of the Psycholinguistic Coding Manual. There was no significant differences found on Total Content Count for the post hoc comparison of Daytime Sleep Onset vs Nocturnal REM reports.

## Acknowledgements

A dream which is not interpreted is like a letter which is not read.

## TALMUD BERAKOTH 55A

To paraphrase the above similarity one might say that data which are not analyzed are like a dream which is not interpreted. The data collected for this study was given to me to use for my dissertation by the other members of the research group who gathered it, namely, Dr. Paul Glovinsky, Dr. Lissa Weinstein and Professor Steve Ellman, my mentor for this project. I owe a great debt to them which I hope I have begun to be repay by the completion of this data analysis. Beyond the provision of the raw data, each of these individuals contributed in different ways to my work and to my completing this dissertation. I am grateful to Paul for many things - from teaching me the technical aspects of sleep laboratory work to the availability and support he has given me through out the many years. I am grateful to Lissa for many things - from teaching me about sleep mentation analysis and training me to use her scaling techniques to the very concepts which she has articulated so well in her writings and which I have relied upon in conceiving and completing the data analysis. It is in this vein that I also thank my mentor, Steve Ellman, who has guided me in every aspect of this dissertation - intellectually, methodologically and motivationally. His

approach to psychoanalytically-informed research, looking to Freud as the source of viable research directions, was at the heart of my work. I thank him for the inspiration to do this dissertation and for his help and patience.

I would like to thank Professor Larry Gould and Professor Michael Moskowitz for consenting to be on my dissertation committee. Knowing that they were there and interested in my work has made all the difference in completing this work. I thank Larry for having been a supportive teacher all these many years I have been in the City College Doctoral Program in Clinical Psychology. His presence, though in the background, was strongly appreciated and has helped me enough to get through.

Sleep research is labor-intensive, as this series of acknowledgements demonstrates. In the latter periods of the work on this dissertation I had help from a number of people. For their invaluable help, I would like to thank my research assistants who helped me code sleep mentation reports, Joy Settembrino and Eliza Coleman. They were not only "blind" judges, but have truly helped me in clarification of the procedures and improvement of the scaling instruments, and their skills as scientific psychologists, with clinical sensibilities made their contribution indispensable.

There are several individuals who I would like to thank especially. One is my friend, Dr. Robert Pierro, who has

given his time and who has been interested in my work and my professional development. Bob has never given up on me and I thank him for it. I thank him for helping me to find research assistants, for reading through the many versions of the proposal and the many suggestions he has made to the procedures and the statistical analysis of the data. This would not have gotten done without him.

I thank my wife, Bari Smelson, whose love and caring have helped me to complete this dissertation. Her contribution to the data processing and analysis totalled many hours, even days. I will always be grateful for the work she has done with me, for her abiding good humor, loyalty and faith. She is entitled to share the pride and joy of accomplishment in the completion of this work.

I would also like to thank my family for their support through out the many years I have been a student. My aunt, Jean Mary Carroll and my mother, Elizabeth Carroll have been especially important in giving me what I needed. My gratitude to them is inestimable.

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## Chapter I

### Introduction

This dissertation recounts an experiment which investigated mentation during Rapid Eye Movement [REM] sleep and during Daytime Sleep Onset [DSO]. The experiment which will be described in later chapters addressed the effects of REM sleep deprivation on nocturnal Rapid Eye Movement Period sleep mentation as compared to the effects of REM deprivation on Daytime Sleep Onset mentation. The research strategy employed in this experiment applied methods and instruments previously shown to be effective in demonstrating the effect of REM deprivation on nocturnal REM and nonREM sleep mentation. The hypotheses and predictions for the current study are based on a particular interpretation of the phasic-tonic model of sleep presented in Weinstein, Schwartz & Ellman (1988, 1991) and Ellman & Weinstein (1991). These two papers present a model of REM sleep and dreaming based on an assumption derived from the early work of Dement in the 1960's, that one of the effects of REM deprivation will be the displacement of REM-like phenomena into other stages of nocturnal sleep (Dement, 1965). The following chapter will contain a brief review of the literature which has devolved from this assumption. At this point I will briefly introduce those aspects of REM

sleep deprivation and sleep mentation which are most significant for the present dissertation.

Among the research findings presented in the papers cited above are the results of the doctoral dissertations of Schwartz (1979) and Weinstein (1981). Schwartz (1979) reported a greater mental immersion or absorption in the dream experience during phasic REM sleep mentation reports. Weinstein (1981) was first to show the effects of REM deprivation on sleep mentation in nonREM-Stage 2 sleep, using those measures from Schwartz (1979) that were associated with the presence of phasic events. These findings were seen as demonstrating a spill-over of REM phenomena into other stages of sleep as Dement had suggested. Schwartz and Weinstein employed a psychological construct, Absorption in Mentation [AIM], that served as a mediator of the link between physiological events (Rapid Eye Movements) and psychological events (mentation reports). The psychological construct of Absorption in Mentation has served as an intervening variable, derived from a broader ego-psychological view of psychological functioning during fantasy and daydreaming articulated by Schafer (1968), that has been incorporated by these writers into a model of sleep mentation that explains psychophysiological relationships, in particular, between phasic events such as rapid eye movements and more dreamlike sleep mentation.

The Absorption in Mentation [AIM] scales are a group of

unidimensional rating scales that measure several aspects of sleep mentation. These dimensions, e.g. reality of mentation experience, intensity of affect, global immersion, temporal discontinuity, grammatical self representation, etc., constitute different aspects of mentation previously seen to be associated with phasic events (i.e. rapid eye movements) in REM sleep. An important contribution made by Ellman and the graduate students who worked with him was the recognition of the coalescence of these dimensions around a psychological construct that has notable theoretical depth and clinical breadth. The idea is that of the Suspension of Reflective Self-Representation [SRSR] conceived of as an ego-function and discussed by Schafer (1968) in his psychoanalytic formulation of the loss of subjective awareness that accompanies one's immersion in fantasy experience. The interpretation given to the phasic-tonic model by Ellman and his colleagues holds that the occurrence of phasic activity in sleep is the physiological mediator of such a loss of reflective self-awareness. These researchers were able to demonstrate the psychological effects of REM deprivation using these scales to index the degree of self-reflective awareness in mentation reports from NREM and REM sleep.

In commenting on Pivik's (1978) review of the phasic-tonic model in the first edition of The Mind in Sleep, Ellman (1978) called our attention to the relative lack of

psychological hypotheses employed in the field of sleep research with respect to interpreting the phasic-tonic model. The present research project constitutes an attempt to respond to Ellman's observation that "we will have to seriously consider how a person actively processes endogenous stimulation rather than simply attempting to formulate research questions in terms of how types of endogenous stimulation are impressed on a passive receiving instrument" (p. 244).

The research presented in the current dissertation was an attempt to replicate previous findings of reliability and discriminatory ability of the AIM rating scales. Previous studies with these scales found that several of the subscales were able to discriminate between phasic and tonic events in nocturnal sleep. A recent dissertation emanating from Ellman's group by Tunney (1992) has applied AIM Scales to nocturnal sleep onset. The current study constitutes the first time the AIM Scales will be used with Daytime Sleep Onset mentation.

The project to be presented in this dissertation was generated within the field of experimental sleep mentation research. While the methods and procedures of this experiment are generally quantitative in nature, significant concepts such as Suspension of Reflective Self-Representation have been drawn from clinically-informed observations about dreaming and human psychology. This is a

study which started out from a particular theoretical point of view about the function of REM sleep. Therefore, there will be a limited conceptual reworking of the findings in the research literature regarding this topic, i.e. the function of REM sleep. This is not to say that such reworking should not or could not be done or that there are not numerous points of view about the function of REM sleep - but simply that the current dissertation is primarily an empirical study and as such it will make a limited contribution towards model-building or theoretical explication.

This dissertation is an empirical study with the aim of testing certain implications derived from a model of REM sleep articulated by Ellman & Weinstein (1991). The work described herein was done with the hope of advancing a multifactor approach to the study of sleep mentation with the main hypothesis that the loss of self-reflective awareness is a central aspect of the dream experience -- one that would correlate highly with the occurrence of phasic activity in various stages of sleep in this case Rapid Eye Movement (REM) sleep and Daytime Sleep Onset (DSO).

### **Context of the research project**

It is important to understand something of the chronology of events and working relationships which generated the research questions and methods for the present

study. Therefore I will briefly recount the process whereby this study was generated and spell out the assumptions and limitations which should be applied in interpreting the present study.

The empirical component of this dissertation is an analysis of mentation reports collected as part of a sleep study at the CUNY City College Sleep Laboratory. Laboratory sleep research is a labor-intensive endeavor and usually requires a team approach: our core research team consisted of Professor Steven Ellman, Professor Arthur Spielman, Dr. Paul Glovinsky, Dr. Lissa Weinstein and the author of the present work. The research team which devised the experimental protocol for the collection of the raw data of the present study encompassed differing perspectives as to the significant variables and areas of emphasis. One segment of this team was interested in the relationship between REM sleep and Daytime Sleepiness. (The findings relating to that topic have been presented elsewhere (Glovinsky, 1985; Spielman et. al., 1986, Glovinsky et.al., 1991)). Thus as a graduate student, Paul Glovinsky, had prepared a research proposal with an experimental strategy chosen to examine that topic, (REM sleep and Daytime Sleepiness), that was based on traditional procedures of REM sleep deprivation by awakenings made during their normal nocturnal sleep period in the laboratory and to then to measure changes in daytime sleep latency, comparing latency

during nap opportunities before and after REM deprivation. Yoked controls received Stage-2 deprivation. A detailed description of methods and procedures of this "host" study is provided in Appendix A of this dissertation. The present writer participated in the development of the experimental protocol utilized to collect the raw sleep mentation reports. I joined this team primarily as a research assistant, learning sleep study techniques and preparing to devise a research project of my own which would utilize this data.

The experimental approach of this "host" study basically employed classical REM deprivation techniques and the data collection methods and structure of analysis appeared suitable to the needs of that segment of the research team interested in the relation of dreaming to the function of REM sleep. As noted above, Weinstein, Schwartz and Ellman (1988, 1991) had reported on a set of scales they had developed that could discriminate phasic from tonic awakenings during REM sleep as well as being sensitive to conditions of heightened phasic activity in Stage-2 sleep following REM deprivation. At the time there was a need for further validation of these scales and replication of findings. These scales had been developed and tested on a single set of mentation reports. The "host" study of the present dissertation offered an opportunity to try out these scales on a different set of mentation reports and

contribute to the ongoing development of these scaling techniques that measure the self-representation and experience of self-awareness in dreaming. Thus, one of the main contributions that could be made by the present study is the further evidence of reliability and validity of the Absorption in Mentation [AIM] scale, both in terms of interrater reliability and construct validity. The intent of the research team was to add a protocol for collection of sleep mentation onto the "sleepiness" study. While the "host" study focussed primarily on "sleepiness" variables, it provided a new set of REM period mentation reports under varying conditions of REM deprivation, (with slight modifications in the methods of eliciting these reports to control for previously confounding elements). Thus, it served as an opportunity to replicate findings concerning the sensitivity of the AIM scales in discriminating conditions of higher phasic activity during REM sleep following REM deprivation. The new set of reports constituted an opportunity to validate previous findings with the AIM scales, utilizing a new set of mentation reports.

Furthermore, the AIM scales had not been tried with Daytime Sleep Onset [DSO] mentation. The "host" experiment provided an opportunity to collect DSO mentation reports under Pre- and Post-Deprivation conditions. This was an opportunity to explore the sensitivity of the AIM scale to

presumed increases in phasic activity during the waking part of the circadian cycle following REM deprivation.

The present dissertation follows an approach similar to that of prior dissertations in this area (Schwartz, 1979; Weinstein, 1981). The primary method is the employment of trained judges to rate individual mentation reports based on several mentation rating scales. The Absorption in Mentation Scale will be compared to other rating scales: the Psycholinguistic Coding Manual for Mentation reports (Antrobus, Schnee, Offer & Silverman, 1977) and the DF Dreamlikeness Scale (Foulkes, 1966). The main analysis consists of a series of planned, orthogonal comparisons of mean ratings of pre- and post-deprivation conditions for Daytime Sleep Onset mentation and Nocturnal REM period mentation. Our major assumption, related to those above, is that REM deprivation produces some displacement of REM phasic activity into Daytime Sleep Onset, (a subtype of nonREM sleep). We applied these scales to Daytime Sleep Onset mentation reports and REM mentation reports obtained from the same subjects and manipulated the potential for phasic events by REM deprivation while also depriving control subjects of equivalent amounts of nonREM-Stage 2 sleep. We were interested in whether nocturnal REM deprivation, a manipulation based on physiological procedures, will affect daytime sleep mentation during napping. We expected that Daytime Sleep Onset mentation

following REM deprivation will be experienced as more absorbing, i.e. more like REM phasic mentation. This increased Absorption in Mentation would be apparent only on dimensions that can discriminate REM phasic from REM tonic awakenings. Thus it was predicted that the increased REM pressure resulting from deprivation of REM sleep would produce greater "dreamlikeness" in both the Daytime Sleep Onset and the intensity of dreamlike quality of Nocturnal REM periods as indexed by Absorption in Mentation. Furthermore it was predicted that REM deprivation would have no effect on Total Recall Frequency as measured by one of the subscales of the Psycholinguistic Coding Manual.

This topic cuts broadly across several issues in current sleep research with implications for pure research into REM sleep processes as well as bearing upon more clinically-based issues. However, there were several quite specific methodological issues in sleep mentation research that the study addressed. The experiment served as a attempt to replicate the findings of Schwartz (1979) and Weinstein (1981) of the ability of the AIM scales to discriminate between mentation reports taken from conditions of higher vs lower likelihood of phasic events, (i.e. between REM deprived and Stage 2 - NonREM deprived conditions) within nocturnal REM periods and within Daytime Sleep Onset. Furthermore, there was an opportunity to replicate the ability of these scales to discriminate

between REM and nonREM mentation, (in this case, Sleep Onset). As the field of sleep research has moved towards cognitive models and strategies in the past decade, (Foulkes, 1980, 1985) the treatment of the subjective experience of the dreamer has declined. This study will address this issue by comparing scales which index the experience of the dreamer with more objective scales which look at the formal aspects of the mentation reports.

Apart from methodological considerations there are substantive questions about the relationship of REM dreaming to Sleep Onset mentation which this study addressed. This has implications for dream production modelling (Foulkes, 1985; Antrobus, 1983) which will be discussed in the following chapter.

## Chapter II

### Review of Literature

The empirical study for which the following review was prepared was originally undertaken with a particular theoretical point of view guiding the hypotheses. This point of view is the particular interpretation of the phasic-tonic model of sleep mentation which has been expounded by Ellman & Weinstein (1991) in the second edition of The Mind in Sleep. The study attempted to validate this interpretation and model with planned contrasts selected to test particular hypotheses drawn from their model. The following literature review will be organized around the hypotheses with the intent of presenting the underlying thinking leading up to those hypotheses. It will begin with a fuller explication of Ellman & Weinstein's interpretation of the phasic-tonic model, with particular focus on the implications for the effects of REM deprivation on nocturnal sleep mentation as this is the area in which the first series of planned contrasts lies. In a subsequent section there will be an attempt to present aspects of the sleep literature dealing with the discrimination of REM period mentation from Sleep Onset mentation and other types of fantasy mentation as there is a post hoc comparison based on

this issue included in the study. However, there will be a limited attempt to integrate the two areas as well as a limited attempt to engage in theoretical exploration or model-building as the main focus of this dissertation is reporting of a piece of empirical work. Furthermore, the general background in the history of sleep research and REM sleep will be dispensed with as it has been reviewed extensively elsewhere (Ellman & Antrobus, 1991).

#### **Psychological and physiological effects of REM Deprivation**

The effects of deprivation of Rapid Eye Movement (REM) sleep on psychological and behavioral functioning have been studied extensively since the inception of modern sleep research. The literature on REM deprivation has been comprehensively reviewed by a number of authors, (Vogel, 1975; Ellman, Spielman, Luck, Steiner, & Halperin, 1978). Since there have been such comprehensive reviews, the current review will contain limited critical analysis. The intention here will be to give a broad description of the trends in the field which have lead up to the findings of Weinstein, Schwartz & Ellman (1938, 1991) and their theoretical framework which is closely tied to the REM deprivation literature. Since we will be looking at the effects of REM deprivation on Daytime Sleep Onset and on REM period mentation in the experiment to be presented, the articles which address the effects of REM deprivation on

these types of sleep mentation will be discussed.

The first REM deprivation [REMD] study was reported by Dement (1960) who found a number of polygraphically demonstrated changes following REMD which have been consistently replicated. Some of the physiological effects of REMD that he found were as follows: 1) More awakenings were required to keep subjects from entering REM sleep as the deprivation procedure progresses (REM pressure); 2) There was increased REM sleep on recovery nights following REM deprivation (REM rebound); 3) There was decreased latency to the first REM period following REM deprivation; 4) An additional polygraphic finding was the increase in the number of eye movements during REM deprivation and recovery nights (REM density.) In explaining the rationale for their studies of phasic events and sleep mentation, Ellman and Weinstein (1991) note that the most significant implications of Dement's work in this area were "(a) that REM sleep is not a unitary entity, but rather a convergence of several processes which usually occur together but can be dissociated, and (b) that the crucial variable in the occurrence of REM rebound was not REM time per se, but phasic activity. If Dement and his colleagues were correct, if phasic activity following REM deprivation is displaced into non-REM sleep, then changes in mentation following REM deprivation would be best assessed with scales that could sensitively discriminate phasic from tonic

awakenings during REM sleep" (p. 378).

The effects of REM deprivation on the quality of sleep mentation was studied by Pivik and Foulkes (1966) who initially found increased "dreamlikeness" (using the Foulkes DF scale) of REM period reports following REM deprivation but not following non-REM deprivation. The mentation reports in this study were taken later during the same night following five interruptions of either REM or non-REM sleep. Foulkes, Pivik, Ahrens & Swanson (1968), in attempting to replicate these findings, subsequently reported no significant differences in dreamlikeness ratings of any sleep reports, neither from REM nor from non-REM. These reports were taken from the following night after either REM or non-REM deprivation. In critiquing this study, Ellman et. al. (1978) pointed out that the methodological irregularities which called into question the effectiveness of the REM deprivation procedures. These irregularities tended to minimize the negative significance of these findings.

Arkin, Antrobus, Ellman, & Farber (1978) reported a series of well-controlled studies of the effect of REM deprivation on NREM mentation. No significant differences were found in ratings of "dreamlikeness" of NREM mentation following REM deprivation as opposed to NREM mentation. Additionally, REM deprivation had no effect on mentation gathered from bedtime sleep onset periods.

The data from the Arkin et. al (1978) study was subsequently reanalyzed in studies by Schwartz (1979) and Weinstein (1981) and Tunney (1992) and Krech (1993), which did demonstrate the psychological effects of REM deprivation on NREM-Stage Two sleep mentation. These studies have viewed the dreamer's reflective self awareness during the dream as an important aspect of the self as it can be found in the dream report. Furthermore, they have shown that this construct, which they have termed Absorption In Mentation [AIM], may be used as a psychological construct to formulate research questions about how a person actively processes the endogenous stimulation associated with phasic events in REM sleep.

#### **The phasic-tonic model and sleep mentation**

The work reported by Weinstein, Schwartz & Ellman (1988,1991), which the currently proposed research project aims to extend, stands in the tradition of sleep mentation research based on the phasic-tonic model. Briefly, this model, drawn from Moruzzi's (1963) distinction between tonic and phasic events in REM sleep, holds that there are behavioral or experiential phenomena which have been experimentally observed to correlate with the presence of phasic physiological events during sleep (e.g. eye movements, saw-toothed EEG waves, middle ear muscle activity, periorbital integrated potentials, etc) and are

distinguishable from those associated with tonic states. The mental phenomena which have been associated with phasic events are as follows: increased feeling of self-involvement and emotionality, Hauri & Van de Castle (1973); feelings of self-participation and movement, Bosenelli et. al. (1974); primary visual experience and decreased thought-like qualities, Molinari & Foulkes (1969), Foulkes & Pope (1973); activity, Berger & Oswald (1962); discontinuity and bizarreness, Watson (1972); dreamlikeness, Ellman et. al. (1974).

Weinstein et. al (1991) have attributed the paucity in findings in the area of REM deprivation to a limitation of current psychophysiological models which posit an isomorphic relationship between sleep physiology and dream content. There is a neglect of psychological hypotheses regarding the way that physiological stimuli are processed. Weinstein et. al. (1988, 1991) have reported that a set of scales which are related to some of these mental phenomena or conceptualizations have been used to rate dreams collected from REM periods and nonREM Stage 2 sleep. In their interpretation of the tonic-phasic model they have combined these experimentally discovered phenomena and conceptualizations listed above with the clinically derived concept of reflective self-representation of Schafer (1968), (defined as the subject's awareness or mental representation of himself as the thinker, daydreamer or dreamer), in

developing these scales which index Absorption in Mentation [AIM].

### Development of AIM Scale

In their doctoral dissertations, Schwartz (1979) and Weinstein (1981) have successfully applied the concept of suspension of reflective self-representation, explicated by Schafer (1968)<sup>1</sup> to understanding the changes in intensity

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<sup>1</sup> Schafer (1968) observed that the essential nature of the changes between normal waking thought or consciousness and daydreaming or reveries lies in the mode or quality of the experience (as opposed to the content). The qualitative change in the experience of the thoughts which distinguish daydream thinking from other thinking is that what is thought is experienced as though it were real - not just thought. Essentially, what changes is an aspect of thought that is a prerequisite of any reality testing, namely, the representation of oneself as the thinker of the thought. Schafer terms this the "reflective self-representation." This is an aspect of thinking which is usually implicit in the thinking process. It underlies the duality of mind which allows one to take one's subjective experience or thoughts as objective phenomena and reflect upon them. This aspect, usually implicit, becomes explicit or is brought into awareness when one is challenged to describe or make explicit the content of one's daydream as a discrete portion of one's "stream of consciousness." It can be observed in the language used to report the thoughts and is embodied by such qualifying propositions as "I was thinking that..." or "I believe that..." or "I remember when..." or "I wonder if..." or "It occurs to me that..." So long as the self is not reflectively represented in relation to psychic experience such as a daydream or the mental experiences during sleep onset, and so long as the self is not readily available for such representation, the mental content, whether it is highly organized and socialized or primitive and unbelievable, may be experienced as real, or "lived in." There is an isomorphic relationship between the two continua, the sense of "realness" of mental experience and the relative suspension of reflective self-representation. Schafer (1968) suggests that there is an oscillation in the suspension of the reflective self-representation during ordinary daydreaming. One's sense or awareness of oneself as the thinker of the thoughts of the daydream ranges in intensity, disappearing at points when the daydream is

of involvement, or immersion in the experience of the nocturnal dreams of experimental subjects. Their findings, reported in Weinstein, Schwartz and Ellman (1988, 1991) indicate that rating scales based on the concept of suspension of reflective self-representation reliably predicted that greater mental immersion was associated with reports taken from REM as opposed to NREM sleep and within REM sleep, was significantly associated with phasic as opposed to tonic intervals. In addition, utilizing the same conceptualizations and scales, Weinstein (1981) found that following deprivation of REM sleep there was a greater

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experienced as relatively real and "lived in" and returning as there is a recognition that the experience is in the mind.

With respect to the mental phenomena of sleep onset Schafer (1968) suggests that it is the satisfying or pleasurable experience of being immersed in the daydream that allows one to temporarily fall asleep in the course of it. As he sees it, when one again represents oneself as the thinker of the thoughts, when the reflective self-representation returns or is heightened, one experiences less satisfaction of the gratification of needs expressed by the daydream, and one awakens. Schafer thus brings into play the issue of drive equilibrium in relationship to sleep onset, although he does not spell out the vicissitudes of this relationship as far as sleep onset is concerned. (Of course, he was not building a model of sleep onset; rather, his delineation of suspension of reflective self-representation as an ego-function related to or part of reality testing was meant to lay the conceptual groundwork for understanding the nature and influence of intense intrapsychic phenomena such as "introjects" which bear some resemblance or relationship to fantasies.) Nevertheless, the delineation of the concept of suspension of self-representation, apart from or including its potential for interacting with a model of need satisfaction and all the complexities which such a model would entail, is a useful conceptualization of the formal aspect of the cognitive changes in the fantasies which occur at sleep onset.

immersion in reports of dreams taken from NREM sleep mentation associated with phasic events. In reports from REM sleep following REM deprivation there were individual differences related to the subjects' mode of reporting anxiety producing thoughts or fantasies such that subjects who tended to focus on anxiety-producing thoughts did not show any changes following REM deprivation.

The Absorption In Mentation Scales [AIMS] are a set of dichotomous and Likert-type scales which index the degree to which the subject experiences their dreams as involving and real. Schwartz and Weinstein applied these scales to sleep mentation data from a sleep deprivation study reported by Arkin, Antrobus, Ellman & Farber (1978), which had been analyzed by other rating strategies but had demonstrated inconclusive effects of REM deprivation on REM or nonREM mentation. Weinstein et al. (1988, 1991) report two experiments with relatively more conclusive results. They found that REM dreams were judged as being more involving than nonREM stage-2 dreams. This was a significant main effect on four of their seven original scales: Reality, Temporal, Global, and also on the Dreamlike Fantasy (DF) scale from Foulkes (1966). (These scales are described in the Appendix B as they were utilized in the current study). Furthermore, several of these scales, (Global, Self-Representation) were significantly sensitive to differentiating reports taken from phasic REM conditions as

opposed to tonic REM conditions, that is reports taken after a burst of eye-movements. This finding endows these scales with a special value in being able to be used in experiments aimed at discriminating between REM and Sleep Onset. Sleep Onset can be considered a "nonREM" stage of sleep and these scales could be further validated on a new set of data as was proposed for the present study.

There is another set of relevant findings from the second experiment in Weinstein, Schwartz & Ellman (1988, 1991) which are concerned with differential sleep stage deprivation. The AIM scales were used to rate reports taken from subjects undergoing REM deprivation, nonREM Stage 2 Deprivation and "recovery" nights. The relevant findings for the predictions to be made in the present study are as follows. Subjects who were likely to be more introspective and to focus on anxiety producing percepts as measured by the Imaginal Processes Inventory<sup>2</sup> Guilty Daydreaming Scale showed no differential pattern of response in their REM mentation, to stage REM deprivation versus stage 2 NonREM deprivation. It was the subjects who tended to avoid such percepts who showed a characteristic pattern of response to

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<sup>2</sup>The Imaginal Processes Inventory is an instrument developed by Singer & Antrobus (1962) that has 22 subscales made up of Likert type scales that purports to measure various aspects of fantasy mentation. It was used by Weinstein et. al (1988, 1991) and also in the studies reported by Arkin et. al. (1978) as a self-report method of evaluating individual differences in attitudes towards fantasy mentation.

REM deprivation, i.e. greater absorption in mentation. It was the AIM scales which successfully discriminated phasic from tonic awakenings during the baseline nights in the first experiment, which significantly showed this greater involvement in mentation. For less introspective subjects, phasic REM reports showed greater global immersion under conditions of REM deprivation than under conditions of nonREM Stage 2 deprivation. Also for less introspective subjects, REM reports show fewer grammatical self-reflective statements during REM deprivation than during nonREM Stage 2 deprivation. For all subjects, REM phasic reports during REM deprivation were rated as more real than REM phasic reports during nonREM Stage 2 deprivation. The DF dreamlike fantasy scale showed no significant effects of REM deprivation vs nonREM deprivation. On recovery nights, nonREM reports showed a greater global immersion and higher DF scores in subjects recovering from REM deprivation (high REM pressure) than subjects recovering from nonREM deprivation. A paradoxical finding was that reports from REM periods during recovery nights showed less global immersion in subjects recovering from REM deprivation than in subjects recovering from nonREM deprivation. These findings have been spelled out in detail in order to prepare for the planned comparisons that will be made utilizing the same scales in the present study.

The experimental design described in the following

Methods section was laid out in such a way as to allow us to make a series of planned contrasts that would attempt to replicate certain findings in Weinstein, Schwartz & Ellman (1988,1991). The particular contrasts allowed in the current study which would replicate conditions tested in the prior studies are: 1) REM period sleep reports under the condition of REM deprivation with REM period sleep reports under the condition of nonREM-Stage Two deprivation; 2) REM periods on Recovery Nights again under REM deprivation vs nonREM Stage 2 deprivation. Although there were many other contrasts of interest, we decided that these would best test the model being validated, while remaining within the bounds of accepted statistical rules of orthogonality.

With respect to further predictions concerning the nocturnal mentation, the model predicts greater REM pressure on consecutive nights of REM deprivation without concomitant REM pressure on consecutive nights of nonREM Stage 2 deprivation. Hence we predicted that there would be greater suspension of reflective self-representation on the second deprivation night as opposed to the first, but only for the REM deprived subjects.

#### **Sleep onset and phasic-tonic model**

There have been a plethora of well known findings regarding the psychological correlates of Sleep Onset mentation as reviewed by Vogel (1978), with few examining

phasic events in particular. Yet Sleep Onset Stage 1 can be seen as a non-phasic analogue or control with which we may compare REM sleep; its EEG is very similar to that of REM sleep and by definition it does not contain the most recorded human phasic event, the Rapid Eye Movement. It would seem that comparing Stage 1-Sleep Onset and REM reports might at least supplement other comparisons such as REM and nonREM-Stage 2 in the investigation of the psychological correlates of phasic and tonic activity.

The early studies of Nocturnal Sleep Onset by Foulkes and Vogel (1965) and Vogel et al. (1966) attempted to trace the loss of awareness that one is having a subjective mental experience, i.e. loss of reality testing over the course of falling asleep. While these early studies did not specifically look at phasic events, there was an attempt to match progressive stages of loss of reality testing with changes in EEG and EOG phenomena. In terms of phasic activity, these early studies indicated the progressive deterioration of reality testing equated with suspension of reflective self-representation during the course of the Sleep Onset process. This was correlated with a loss of alpha from the EEG which occurs during Sleep Onset-Stage 1. The loss of reality testing in Sleep Onset-Stage 2 is increased, while the degree of regressivity of content lessens. Thus, while it does seem to be the case that there is a comparable loss of reality testing in Sleep Onset as

compared to REM, the direct bearing upon the model advanced by Ellman and Weinstein with respect to phasic events is unclear. This is because the phasic activity of Sleep Onset-Stage 2, i.e. K-complexes and sigma spindles, are different from rapid eye movements used in these other studies.

Since the phasic event typically used as the physiological criterion in these sorts of studies, namely rapid eye movements, do not typically occur in Sleep Onset, several papers have reported on the use of high amplitude *theta* bursts which had been shown to be associated with rapid eye movements during nocturnal REM periods. These workers reasoned that this EEG frequency was in the same range as "saw tooth" waves which are unique to REM sleep. "Saw tooth" waves were found to be correlated with the absence of thought or cognitive elaboration (Foulkes & Pope, 1974). Using ratings of Primary Visual Experience based on Molinari & Foulkes (1969) and the discontinuity scale, Pope (1973) used *theta* bursts as an index of phasic events to relate to mental activity during Nocturnal Sleep Onset. He found *theta* bursts associated with a high overall incidence of dream recall. Furthermore, he found more Primary Visual Experience in reports following *theta* awakenings and Discontinuity of report. Foulkes, Scott & Pope (1980) reported on their attempts to use the tonic-phasic model to analyze reports from Nocturnal Sleep Onset reports.

Foulkes, Scott & Pope (1980) found that awakenings made following alpha loss and at a burst of theta were significantly associated with Primary Visual Experience as compared to those awakenings occurring after alpha dropped out but without a theta burst, that is to say, before a theta burst, (53% vs. 32%,  $p = .087$ , Fisher exact probability test.) Their statistical analysis was based on mentation reports as the unit of analysis rather than subjects. Another interesting finding was that subjects reported "seeing through their own eyes" vs. "seeing themselves as an object" on 100% of the pre-theta arousals, but only on 67% of the theta arousals, significant at the .01 level of Fisher's test, two-tailed. These findings reflect the lack of active cognitive mediation in primary visual experience reports. They interpreted their findings as showing some tendency for sleep onset theta bursts, as compared with pre-theta periods, to be associated with primary visual experience. This was similar to the findings of PVE associated with REM phasic events of Molinari & Foulkes (1969).

However, the above difference was only marginally significant and, given that it relies on a test that uses reports rather than subjects as a unit of analysis the findings are weak. This sort of design subtlety which is required to elucidate the effects of phasic theta during sleep onset suggests the complex relationship between phasic

events and sleep onset. While acknowledging that the tonic-phasic model contained "at least a grain of truth", Foulkes took the point of view that the model of the phasic event as a single simple explanation of dream-like quality across sleep stages is inadequate. It would seem that his pessimism was due to the expectation of an isomorphic relationship between physiological and psychological variables, neglecting the need to include intervening variables and concepts that address the way that individuals process the phasic events. His conclusions seem relevant to the conclusions drawn from the following study reviewed here in which individual differences are indeed prominent in the explanation of mentation at Sleep Onset.

A recently completed doctoral dissertation by Tunney (1992) has examined Nocturnal Sleep Onset in the context of the interpretation of the tonic-phasic model advanced by Ellman & Weinstein (1991). This study was based on the data collected by Arkin et. al. (1978) and looked at the effects of REM deprivation on Nocturnal Sleep Onset mentation by applying some of the AIM scales (Reality, Grammatical Self-Representation and Global) and others (Dreamlike Fantasy [DF] and Molinari & Foulkes Secondary Cognitive Elaboration/Primary Visual Experience [SCE/PVE]), to the Sleep Onset reports gathered from that study. Tunney (1992) found no differences between the Nocturnal Sleep Onset reports from REM deprived as compared with nonREM deprived

conditions. Furthermore, the study also failed to confirm a prediction that Nocturnal Sleep Onset would become more REM-like following conditions of REM deprivation, i.e. have a greater suspension of reflective self-representation as measured by the three AIM scales previously shown to be the best discriminators of phasic events. The AIM scales did not appear to be sensitive to any potentiation of phasic events during Nocturnal Sleep Onset. However, there were significant differences on some AIM scale ratings between groups separated on a continuum of High Access to Fantasy [HAF] vs. Low Access to Fantasy [LAF]. These individual differences were essentially assessed in the same way as high- and low-guilt fantasy subjects were assessed in the Weinstein (1981) study, using a split on the Guilty Daydreaming subscale of the Imaginal Processes Inventory [IPI], (presumably the same subjects as were thus identified in the Weinstein study.) On the Reality, Global and DF scales the LAF group has significantly higher scores than the HAF group, but this individual difference could not be studied under conditions of varying types of sleep deprivation due to the small sample size. Furthermore, a *post hoc* analysis showed the HAF group taking longer to fall asleep than the LAF group suggesting that individuals with lower access to their waking fantasies fall asleep more quickly.

The comparisons which were made in this study as well

as the Foulkes. Scott & Pope (1980) study were based on a design that utilized the mentation report as the unit of analysis. As Tunney notes, one of the most problematic aspects of studying Sleep Onset in human subjects is the practical difficulty in obtaining sufficient numbers of Sleep Onset mentation reports to achieve statistical power. In the statistical analysis of the study to be presented in this dissertation, a repeated measures design is utilized with subjects as the unit of analysis in order to generate the values for the planned contrasts. The power that is lost by the markedly lowered N is made up for by employing the repeated measures analysis. This design is more appropriate to these sorts of analyses in so far as the subject is the unit which is passing through the various treatments, e.g. Pre-REMD or Post-REMD, not the mentation report itself.

The negligible findings of Tunney (1992) may to some extent vitiate the need for a specific comparison in the present study regarding the effects of REM deprivation on Sleep Onset. While she has noted the methodological constraints that were present in her study due to the utilization of a data set which required working within pre-established methodological parameter (and lead to low power within the study), she concludes that it is possible that REM deprivation produces no effect on Sleep Onset mentation which is comparable to that which RD produces on REM and

Stage 2 mentation. She invokes Vogel's (1978) suggestion that even though Sleep Onset resembles REM mentation physiologically, there may be fundamentally different mechanisms at work in the production of "dreamlike-mentation" during these two kinds of sleep. Individual differences in the sleep onset process also support the idea that Sleep Onset is a discrete and unique aspect of sleep and the mentation of this period may respond to REM deprivation in a very different way than the mentation of REM or Stage 2 sleep.

#### **The discriminability of Sleep Onset and REM Sleep mentation**

The following section of the review of literature will present the contributions of laboratory based sleep and dream research to the discrimination of sleep onset mentation from REM mentation. I will attempt to demonstrate the significance of the representation of the self in the mentation report as an important discriminating factor between REM mentation and sleep onset mentation. It will be the aim of this review to suggest an approach to the analysis of a set of laboratory data collected as part of a larger study of sleep onset and REM sleep mentation.

From the beginning of the modern laboratory studies of sleep and sleep mentation, the discriminability of REM mentation from sleep onset mentation has had theoretical and empirical significance. The electrophysiology of these two

sleep states has such similarity as to have led early researchers to speak of REM as "emergent" or "ascending" Stage 1 (Aserinsky & Kleitman, 1955; Dement & Kleitman, 1957). The exclusive position of REM sleep as the sleep stage associated with dreaming was threatened by the presence of dreamlike mental phenomena during sleep onset. The discovery of "dreamlike" mentation during sleep onset (as opposed to the flashes of light and other brief sensory distortions typically associated with the hypnagogic state) has stuck like a thorn in the side of broad dichotomies such as the electrophysiologically defined categories for the physiological correlates of dreaming such as REM-NREM stages or phasic-tonic activity. Since phasic events of REM sleep such as REMs, PIPs or MEMAs do not typically occur during sleep onset, it has been hard to compare the physiology of sleep onset to REM sleep. There are phasic events which do occur during sleep onset, such as theta waves in the EEG, however these are difficult to record electrophysiologically (Foulkes, Scott & Pope, 1980) and there is no reason to associate them with the phasic events of REM sleep. Thus, while there is some similarity in the EEG of REM and sleep onset, there are significant differences as well. There has been little resolution as to the possible physiological correlates of the vivid, dreamlike, phenomena of sleep onset versus the dreams of the REM period.

Several studies have examined the relationship between

sleep onset mentation and mentation gathered from other stages of sleep, later during the sleep cycle, most specifically during REM sleep and stage 2 sleep. Foulkes, Spear & Symonds (1966) found greater variability of "dreamlikeness" in sleep onset mentation than REM period mentation. This study compared sleep onset and REM period reports for the same subjects and found that overall the reports from REM and sleep onset did not differ in mean length, DF rating, aggression, sexuality or hedonic tone. However there were differences in the distribution on the DF "dreamlikeness" scale. Sleep onset reports tended to be distributed around the center of the scale while REM reports were found to have a bimodal distribution at the extremes of the scale. The frequency of REM bizarre, hallucinatory reports was twice that of the sleep onset frequency. There was no intrasubject correlation between REM reports and sleep onset on reports on dreamlikeness, sex, aggression or hedonic ratings. In reviewing these early studies, Vogel (1978) made the case for different psychological mechanisms underlying the quality of sleep onset and REM mentation. He suggests that sleep onset fantasy is initiated by ego regression, that is to say, it reflects a change in ego functioning as a result of loss of volitional control over the course of mentation as well as a loss of "nutriment" or external stimulation as sensory information from the environment is reduced. Vogel (1978) suggests that REM

mentation is more associated with the endogenous, physiological substrata of REM sleep.

Vogel, Barrowclough & Geisler (1972) utilized a construct which they termed "regressivity" as a dimension of mentation which would discriminate reports from various stages of sleep. Their composite "regressivity" scale was composed such that more regressive content was that which was more visual, more perceptual, more affective, less thought-like, less hedonically neutral, less concerned with contemporary life, more concerned with past life, more bizarre, more implausible, more novel, more "lived in", under less volitional control, accompanied by less awareness of the environment and more hallucinatory. Judges were trained in these criteria and given the task of identifying from which sleep stage a mentation report was taken: non-REM, sleep onset, or REM. Although there was considerable overlap, and although most reports were in the middle of the regressivity continuum, the results did show that the average NREM reports were least regressive, SO next and REM reports most regressive. Judges were also asked to discriminate between pairs of reports as to the stage with which the report was associated: REM- NREM, REM-SO, NREM-SO. The results of the discrimination judgement was a high proportion of discrimination misses. The authors found that about 50% of the REM reports were sufficiently non-regressive as to be called SO reports and that 20% to

25% of the SO reports were sufficiently regressive as to be called REM reports. Also, although the regressivity order would imply that REM-NREM distinction should be better than REM-SO distinction, this was not found to be the case. The authors concluded that in terms of gross regressivity the high proportion of discrimination misses indicated that SO and REM mentation did not have a unique degree of regressive content.

In discussing this study, Ellman (1973) suggested that the relative lack of discriminability of the sleep stage mentation found in this study could have been due to the judges' inaccuracy in making REM-NREM discriminations as compared with other studies in which judges had achieved higher accuracy, e.g. Monroe et.al. (1965) who found a high degree of reliability in judges making a discrimination between REM and NREM (stage 2). Responding to this criticism, Vogel (1973) reported using his same judges to make REM-NREM discriminations on 227 reports from Monroe's study and found that indeed his own judges did not do as well as Monroe's. While Monroe's judges averaged 80% discriminability between REM-NREM, Vogel's judges averaged 67.8%. This difference, though small, is significant at less than the .001 level. Vogel acknowledged that his original conclusions viz. that SO reports are frequently indiscriminable from REM reports is to some extent weakened. The discriminability of Sleep Onset and REM period sleep

mentation has continued to pose questions in more recent studies and has been important in certain modelling of cognition during sleep as will be discussed in the next section.

### **Self-representation in Sleep Onset mentation**

At the beginning of the 1980's, Foulkes (1981) gave a paper at the European Congress of Sleep Research which reflected the imminent turn of the sleep mentation research field towards the study of cognitive factors such as attention, memory, language structures in the psychology of dreaming. This was associated with the fact that some researchers began to turn to highly objective ways of analyzing dream content. Possibly referring obliquely to the findings of Weinstein et al. (1988) it had been noted by a number of authors, (Foulkes, 1985; Antrobus, 1983) that judges could discriminate REM mentation from mentation of other stages of sleep better on the basis of "global" guesses rather than when they were using a rating scale that employed the criteria of imagery, hallucination and bizarreness. The question then becomes, what sort of information were these judges using when they made the "free guesses." Evidently, the judges were using some information other than that used on rating scales with particular contents.

The findings of several authors suggested that the additional information may have been the length of the

report as can be seen from the studies by Foulkes and Schmidt (1983) and Antrobus (1983). Foulkes and Schmidt (1983) found that REM reports tend to have a thematic sequence of at least more than one temporal unit 80% of the time where as Sleep Onset reports had more that one temporal unit only 47% of the time. Futhermore, REM reports averaged 5.5 temporal units where as sleep onset reports averaged 1.6 temporal units. Thus, in terms of a sequence of narrative episodes, REM reports are longer than sleep onset reports.

Antrobus (1983) compared REM to NREM (stage 2) using the Psycholinguistic Coding Manual for Mentation, (Antrobus, Offer, Schnee, Silverman, 1977) to analyze reports on the basis of the frequencies of different classes of words in the reports and included a count of all words communicating a sense of the Dreamer Participation in the scene as one of the classes of words. He reported that Total Content Count, total word frequency minus pauses, fillers, corrections and commentary discriminated REM from NREM stage 2 reports with approximately the same strength as did global ratings of dreaming and concluded that judges assessing dreamlikeness implicitly rely on a dimension based on this total recall frequency essentially based on word count. On the other hand, he found that his measure of Dreamer Participation added little to the discriminability of REM vs NREM reports that was not already accounted for by Global judgements of

dreamlikeness.<sup>3</sup>

As experimental sleep mentation research has begun to view dreaming as a mental process to be studied as any other cognitive process, the dreamer's experience of himself has been overlooked. However, the way that the individual experiences his mentation has been addressed in the work of Weinstein Schwartz & Ellman (1988, 1991). They have viewed the dreamer's reflective self awareness during the dream as an important aspect of the self as it can be found in the dream report. Furthermore, they have shown that this construct, which they have termed absorption in mentation, may be used as a psychological construct to formulate

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<sup>3</sup> A debate was carried out in the literature between Foulkes and Antrobus regarding the relative importance of retrieval and attentional processes vs dream constructional processes. Antrobus (1983) saw the finding that the Global judgements of Dreaming added little if anything to Total Content Count as suggesting that the fundamental cognitive difference between Stage REM and Stage 2 is the ability of the subject to recall and describe the event of which he was aware prior to making the report. It was the ability to recall more that distinguished the REM reports from nonREM-Stage 2 reports. He argued that the longer REM report is partly attributable to better selective attention to private events and to better ability to follow instructions from the previous waking state (Antrobus et al. 1978). Foulkes (1983,1985) on the other hand found residual, nontrivial differences in cross-stage report comparisons where quantity was held constant. These differences were seen in the area of the representation of characters, both of self-characters and other characters such that a general deficit in the number of characters was found in nonREM-Stage 2 reports and a specific deficit in the number of self-characters in Sleep Onset reports as compared with REM reports. While Foulkes tends to agree with Antrobus in positing a common dream production system for all stages of sleep, there are remaining differences in the number and nature of memory elements offering themselves for processing by this system.

research questions about how a person actively processes the endogenous stimulation associated with phasic events in REM sleep. In a review of current trends in sleep research, Weinstein, Schwartz & Arkin (1991) have observed a growing interest in "self-representation in dreaming." These writers place within this trend towards examining aspects of self and self-experience during dreaming, the work they have done with Ellman on measuring the subjective experience of absorption in mentation in dreams (Weinstein, Schwartz & Ellman, 1988, 1991). It is possible that the scales of Weinstein et. al. are more sensitive to the aspects of the report that reflect the subject' being more immersed in the mental experience, more involved in or participating in the experience. The AIM scale which they have devised utilizes several related dimensions to index the degree of absorption in mentation which accompanies the suspension of reflective self-representation.

Ellman & Weinstein (1991) have given cause for renewed interest in the psychophysical correlations of sleep mentation and the phasic-tonic model by showing that there is a reliable psychophysiological correlate of phasic activity (eye movements in this case). This association was most clearly demonstrated when intervening psychological processes such as individual differences on attitudes towards fantasy were taken into account. It is notable that they also looked at the way subjects experience dream or

fantasy mentation, rather than looking primarily at the content of form of the dream report as has been done by recent researchers in this area, (Antrobus, 1983; Foulkes & Schmidt, 1983; Bosinelli et.al 1982). In examining the mentation reports in this way, i.e. from the point of view of the subject' experience, they have specifically demonstrated that for some subjects, REM deprivation will give rise to a subjective experience of more involving mentation and for others, REM deprivation will lead to a less real seeming situation. The current dissertation is a follow-up on their work, with a specific application of their approach as we analyze the relationship of Sleep Onset mentation to REM mentation and the effects of sleep deprivation on both these types of sleep mentation.

There are a number of implications to be noted in the literature reviewed. One implication is that there are some methodological questions regarding the ability of judges to make discriminations of sleep mentation reports from sleep onset and REM. Related to this is the issue as to what dimension of the reports are they using to make their discriminations. Are they using length of the reports as Antrobus (1983) and Foulkes & Schmidt (1983) suggest, or are they using some other aspect of the self-experience or self-representation of the dreamer who is making the report? Is self participation an aspect of the report indexed by the

presence of a self character in the narrative? Or is this aspect of the report a more global impression about the subject's immersion in his experience. In summarizing the recent studies on sleep onset mentation, Bosinelli (1991) noted that differences between the REM and sleep onset are often interpreted in quantitative terms even when they appear as qualitative aspects of the sleep mentation report. Indeed, researchers have utilized scales which have ranged from a subjective impression of the judges, based on more or less loosely defined aspects of the mentation reports, to word counts and more specified, objective or public aspects of the dream report and the interpretation of the significant aspects of the report. Bosinelli concludes, however that there are residual qualitative differences that are not easily attributable to quantitative factors and that many theoretical formulations have been offered in the interpretation of the observed differences. As a result it seems to me that what constitutes an artifact in one study, whether it is a quantitative measure such as word count or a more qualitative one such as self-participation, will become the critical variable in another study.

### **Hypotheses and Predictions**

The data for this investigation consist of mentation reports and physiological measures gathered as part of a laboratory experiment on daytime sleepiness and differential

sleep stage restriction discussed briefly in the Introduction and in the Appendix A. These data were gathered with several rather general objectives in mind (as discussed in the first chapter). The specific analyses of the mentation data will be spelled out in the following Methods chapter. The recent literature suggests several questions and methodologies which are relevant and appropriate to the structure of the data already collected. The variables which can be looked at in this study are somewhat constrained by the design and protocol of the study which served as the source of the mentation reports. The specific contrasts (which were undertaken so as to take full advantage of the REM deprivation conditions in the present study) compare Daytime Sleep Onset before the two nights of either REM or Stage 2 deprivation with Daytime Sleep Onset mentation after the deprivation. The present study is an attempt to enhance the calibration and validation of AIM scales by employing more rigorous reliability procedures and comparing these scales to other scaling techniques.

As briefly summarized here, there are both methodological and substantive experimental questions addressed by the current dissertation. However, there are several limitations which bear upon this work. One critical limitation is that while we are employing the phasic-tonic model as an underlying theoretical perspective, the experimental methodology does not include an objective

criterion for phasic events during Daytime Sleep Onset. To some extent this is because it is very difficult to define what constitutes a phasic event during this period of sleep, (Pivik, 1978) as well as to identify electrophysiologically, the phasic events occurring during Daytime Sleep Onset. Nevertheless, based on prior findings and the theoretical model being employed, we are assuming that there is a heightened likelihood of phasic events following REM deprivation and will make our predictions based on this assumption.

As has been stated, the current dissertation represents an attempt to carry forward an empirical analysis of mentation data collected as part of a larger, multifaceted study. This study generated a great deal of raw data, and as is the case with most research, one of the tasks has been to decide on the most appropriate and scientifically legitimate way to analyze the mentation data. Given the complexity of the data set, it was decided that the empirical analysis of the current dissertation would be based on a theoretical model for which there has already been empirical findings (Ellman & Weinstein, 1991). In order to maintain appropriate scientific method a series of planned, orthogonal comparisons were made which were based on the extensive prior research and experience of members of the research team, namely Professor Ellman, the mentor of

this dissertation.<sup>4</sup> We were justified in having made the following predictions based on prior findings which demonstrated the increased Absorption In Mentation following REM deprivation during REM periods.

- 1) We expected to find that Daytime Sleep Onset reports following REM deprivation would show greater Absorption in Mentation than those pre-Deprivation, while reports from Stage 2 Deprived Subjects would not show such a change.

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<sup>4</sup> The following are some textbook discussions of the statistical approach of planned orthogonal comparisons: "In some research applications, you are in the enviable position of being able to specify, prior to data collection, highly explicit alternative hypothesis with respect to differences or patterns among cell means. In such happy circumstances, planned comparisons provide a powerful alternative to the practice of the omnibus F tests followed by post hoc comparisons. As long as the entire analysis uses up no more than the available degrees of freedom and all comparisons are mutually orthogonal, no adjustment of tabled critical F is necessary, and all tests are done within the stated level of alpha error" (Tabatchnick & Fidell, 1983, p.43).

Also, "Planned comparisons are usually the motivating force behind an experiment. These comparisons are targeted from the start of the investigation and represent an interest in particular combinations of condition-not in the overall experiment. Planned comparisons are examples of what Tukey (1977) call confirmatory statistical analysis, where specific questions that can be confirmed or disconfirmed are tested in an experiment" (Keppel, 1983, p. 165).

The current experimental analysis is based on a series of planned, orthogonal analyses, with several post hoc comparisons analysed as such. This is spelled out further in the later sections of this dissertation.

- 2) We expected that there would be greater Absorption in Mentation in REM period reports following REM sleep deprivation than following Stage 2 deprivation.

The preceding predictions were allowed as orthogonal comparisons within the data structure we imposed on the "host" study, (see Figure 2 in the Methods section, p.64).

Two sets of post hoc comparisons were carried out. Given that some of Weinstein et. al.'s reported findings had been specifically from the analysis of first deprivation and second recovery night mentation, a post hoc analysis was conducted based on a breakdown of the nocturnal mentation reports (as illustrated in Figure 3 in Methods section, p. 67). We examined the following comparisons:

- 1) We wondered if, for REM deprived subjects, there would be an increase in Absorption in Mentation in comparing reports taken from the second night of REM deprivation as opposed to those taken from the first night of REM deprivation where as reports from Stage 2 deprived Subjects would not show such a difference.
- 2) Looking at Recovery night mentation, we wondered whether reports from REM deprived Subjects would show greater Absorption in Mentation than those from Stage 2 deprived Subjects.

A second set of post hoc comparisons were conducted and are reported on at the end of the discussion section. Given the interest in the discriminability of REM from Sleep Onset mentation, a post hoc comparison of Absorption in Mentation reports from these two conditions was carried out.

## Chapter III

### Methods

There were two objectives in this experiment. The first objective, primarily methodological, was to attempt to replicate interrater reliability of the Absorption In Mentation [AIM] scales reported by Weinstein, Schwartz & Ellman (1988, 1991) utilizing a new set of mentation reports. It was also intended that these scales would be compared to other scales used in research on sleep mentation; namely, the Psycholinguistic Scoring Manual for Mentation Reports, (Antrobus, Schnee, Offer & Silverman, 1977; Antrobus, 1983) and the Dreamlike Fantasy Scale (Foulkes, 1965) and the Primary Visual Experience scale of Molinari and Foulkes (1968). In addition to replication of the interrater reliability of the AIM scale, another important methodological question we had was the relative usefulness of subjective ratings vs objective ratings of sleep mentation. This is an inherent comparison between the AIM scales and the subscales of the Psycholinguistic Scoring Manual.

The second objective involved experimental criteria: to attempt to discriminate the effects of differential sleep stage deprivation upon nocturnal REM sleep and daytime Sleep Onset. This was an attempt to replicate the findings of

Weinstein, Schwartz & Ellman (1988, 1991) that greater absorption in nocturnal mentation followed REM deprivation. The present study attempts to extend these findings to Daytime Sleep Onset.

#### **Procedures for Collection of Raw Data and Mentation Reports**

The data for this study was collected during an earlier study of daytime sleepiness and differential sleep stage deprivation. The research on sleepiness and REM deprivation has been presented in Glovinsky et. al. (1988, 1990). The research reported in the present dissertation is the first to look at the mentation data from this study. Appendix A contains a complete summary of the procedures involved in collection of the raw data, i.e recruitment and screening of subjects, polysomnographic recordings, individual difference data, etc. The "host" study was a multifaceted project, and the main variable in that study was "sleepiness." I will briefly sketch out the research protocol and emphasize the procedures most relevant to the collection of mentation data which are presented in this dissertation.

|  |  |   |
|--|--|---|
| <p>Pre-Deprivation<br/>Daytime Sleep Onset</p> <p>Subjects get Five<br/>Nap Opportunities<br/>during the day.</p> <p>Begin about 2 hours<br/>after they wake-up.</p> <p>Approximately at<br/>following hours:<br/>10 AM, 12 NOON<br/>2 PM, 4 PM, 6 PM.<br/>Mentation report<br/>taken after every<br/>nap opportunity.</p> | <p>Interim Daytime<br/>Subject spends day<br/>at home on their own</p>   | <p>Post-Deprivation<br/>Daytime Sleep Onset<br/>(similar to pre-dep)<br/>Subjects get Five<br/>Nap Opportunities<br/>during the day.</p> <p>Begins about 2 hours<br/>after they waken in<br/>the sleep laboratory</p> <p>Same times used as<br/>Subject got for pre-<br/>dep. Mentation<br/>report taken after<br/>every nap.</p> |
| <p>First Deprivation<br/>Night</p> <p>Subjects get either<br/>REM deprivation or<br/>Stage 2 deprivation</p> <p>Two REM mentation<br/>reports taken:<br/>Early = 1st REMP<br/>after 2 hrs<br/>of sleep.</p> <p>Late = 1st REMP<br/>after 4 hrs<br/>of sleep.</p>   | <p>Second Deprivation<br/>Night</p> <p>Same procedures as<br/>first deprivation<br/>night.</p> <p>Subjects are again<br/>deprived of REM or<br/>Stage 2.</p> <p>Early and late<br/>reports are taken<br/>from REM periods.</p> | <p>Recovery Night</p> <p>Subjects allowed to<br/>sleep uninterrupted<br/>throughout the night</p> <p>Subjects awakened<br/>from Stage REM<br/>at an Early and Late<br/>REM period.</p> <p>Early and late<br/>reports are taken<br/>from REM periods.</p>  |

Figure 1 - Schematic outline of laboratory procedures used to collect raw mentation and polysomnographic data.

A schematic description of the laboratory protocol is presented in Figure 1. Following a screening interview and random assignment to a deprivation condition (REM deprivation or nonREM/stage 2 restriction), subjects entered a three-day protocol with the following structure. They arrived in the laboratory in the morning of the Pre-Deprivation Day, approximately two hours after they had woken up that morning. They were oriented to the study and read a set of written instructions which described their role and orientation to the collection of mentation reports. (These instructions are included in Appendix C.) There were five nap opportunities during this first day, each spaced two hours apart, as is customary with the Multiple Sleep Latency Test [MSLT]. At the end of each nap opportunity, a mentation report was elicited with the four questions/probes described in Appendix A, under subsection (H) Collection of Mentation Data. (The report was recorded on audiotape with the subject lying in bed in the dark, sound-proof room. The experimenter who was running the polysomnograph read the questions to the subject over the intercom.) That night, and the following night, the subject entered the sleep chamber at their normal bedtime (an average of their bedtimes during the prior two screening weeks) and remained there for their "normal" time in bed (again, an average of their time asleep at home during the prior two weeks). During these two nights they were deprived of either REM

sleep or Stage-2 sleep. Those subjects who had been assigned to REM deprivation condition, were woken as soon as REM sleep began. The other group, Stage-2 deprived subjects, were individually and randomly "yoked" to a REM deprivation subject and received the same number of awakenings from Stage-2 sleep as did their REM deprivation counterpart.

Among all the awakenings done to achieve REM deprivation or Stage-2 restriction, there were two mentation reports taken from REM sleep for each night, one early and one late. In order to get REM period mentation reports, it was obviously necessary to allow some REM sleep to develop in both the REM deprived subjects and the Stage-2 deprived subjects. For the REM deprivation Subjects, we allowed only two instances of REM sleep to develop per night. These reports were taken following the first burst of rapid eye movements (our "phasic-event" marker), following two minutes of REM sleep. For the Stage 2 deprivation subjects, the reports were elicited from awakenings from REM periods, again, following the first burst of rapid eye movements, after two minutes of REM sleep had elapsed.

Following the second night, the subjects remained in the laboratory for the Post-Deprivation Day. During this day they had another set of five nap opportunities, the same as their first day, with another set of Daytime Sleep Onset mentation reports (Post-Deprivation) being generated, after

two nights of deprivation of either Stage REM or Stage-2 sleep.

The subjects stayed in the laboratory for the third night which was a Recovery night - subjects were allowed to sleep nearly uninterrupted for the whole night. They were awakened only twice, for mentation reports, again, during early and late parts of the night and following the first REM burst that occurred two minutes into the particular REM period chosen for the awakening. (For the operational definition of "early" and "late" see Appendix A.)

#### **Recruitment of Subjects**

A complete description of the criteria and process of recruitment and screening of subjects is included in the Appendix A. Many of the screening issues involved in that process are more pertinent to the sleepiness variable than to issues concerning the mentation data. One aspect of the subjects' demographics which is relevant to the mentation data presently under consideration is that several of the subjects were not native speakers of English. This had a significant impact on the analysis of the current study. Several of these subjects were not included in the final comparisons, in one instance because the subject did not provide enough reports, and other instance because the other subject failed to reach Stage One during any of the Pre-deprivation Daytime Nap Opportunities.

Table 1 - Summary of Obtained and Expected Numbers of Mentation Reports by Subject and Condition

| Subj ID Numb | Pre Dep Daytime Reports | PostDep Daytime Reports | Nite 1 REMP Reports | Nite 2 REMP Reports | Nite 3 REMP Reports | Total NoctREM Reports |
|--------------|-------------------------|-------------------------|---------------------|---------------------|---------------------|-----------------------|
|              | obt/exp                 | obt/exp                 | obt/exp             | obt/exp             | obt/exp             | obt/exp               |
| 01           | 4 (5)                   | 5 (5)                   | 2 (2)               | 2 (2)               | 2 (2)               | 6 (6)                 |
| 02           | 4 (5)                   | 5 (5)                   | 0 (2)               | 2 (2)               | 2 (2)               | 4 (6)                 |
| 03           | 5 (5)                   | 5 (5)                   | 2 (2)               | 2 (2)               | 2 (2)               | 6 (6)                 |
| 04           | 5 (5)                   | 5 (5)                   | 2 (2)               | 2 (2)               | 2 (2)               | 6 (6)                 |
| 05           | 3 (5)                   | 4 (4)                   | 2 (2)               | 2 (2)               | 0 (2)               | 4 (6)                 |
| 06           | 5 (5)                   | 5 (5)                   | 2 (2)               | 2 (2)               | 2 (2)               | 6 (6)                 |
| 07           | 5 (5)                   | 5 (5)                   | 2 (2)               | 2 (2)               | 2 (2)               | 6 (6)                 |
| 08           | 4 (5)                   | 5 (5)                   | 1 (2)               | 1 (2)               | 1 (2)               | 3 (6)                 |
| 09           | 5 (5)                   | 5 (5)                   | 2 (2)               | 1 (2)               | 2 (2)               | 5 (6)                 |
| 10           | 5 (5)                   | 5 (5)                   | 2 (2)               | 2 (2)               | 2 (2)               | 6 (6)                 |
| 11           | 5 (5)                   | 5 (5)                   | 2 (2)               | 2 (2)               | 2 (2)               | 6 (6)                 |
| 12           | 4 (5)                   | 3 (5)                   | 2 (2)               | 2 (2)               | 2 (2)               | 6 (6)                 |
| 13           | 5 (5)                   | 4 (5)                   | 2 (2)               | 2 (2)               | 2 (2)               | 6 (6)                 |
| 14           | 4 (5)                   | 5 (5)                   | 2 (2)               | 2 (2)               | 2 (2)               | 6 (6)                 |
| 15           | 5 (5)                   | 5 (5)                   | 1 (2)               | 2 (2)               | 1 (2)               | 5 (6)                 |
| 16           | 5 (5)                   | 4 (5)                   | 2 (2)               | 2 (2)               | 2 (2)               | 6 (6)                 |
| Total        | 73 (80)                 | 75 (80)                 | 28 (32)             | 30 (32)             | 28 (32)             | 88 (96)               |

Table note: Shaded areas indicate subjects in REM deprivation condition. Non-shaded areas indicate subjects in Stage 2 deprivation. Subject 05 was eliminated from final analysis due to insufficient number of legitimate reports from correct sleep stage and difficulty with the interview protocol that may have resulted from being a non-native speaker of English.

### Collection of Mentation Reports

As illustrated in Table 1, the original plan was to collect a total of 256 mentation reports - 80 reports from Pre-Deprivation conditions, 80 reports from Post-Deprivation conditions and 96 reports from Nocturnal REM periods. There were 16 opportunities for a report to be elicited for each subject: five on the Pre-Deprivation Day, five on the Post-Deprivation Day and two on each of the three nights.

Table 1 also illustrates the actual number of reports successfully collected from all the subjects for the entire study. As can be observed, only six subjects have a full complement of reports; certain subjects simply did not yield any reports for a particular cell/condition, either due to experimenter error or no recall of mentation. There was no systematic pattern in the failure to elicit a report.

Table 1 contains the actual number of reports used per cell in the final analysis of the data. There were many problems with reports for two subjects (5 and 11). Several subjects were ultimately eliminated from the experimental analysis because there were empty cells in the repeated measures analysis and the SPSS computer program dropped them because of lack of cases for the particular subject. This occurred because of the fact that we used a repeated measures design in which the unit of analysis was the subject. If there were empty cells for some of the subjects

for the design as a whole, the subject was dropped. Some of these subjects were non-native speakers of English which made interviewing them somewhat difficult as well as tended to invalidate ratings based on analysis of spoken reports. Furthermore, there is the issue of the actual condition of the awakening made during daytime sleep onset. Some reports from Subject 11 in particular were elicited from an interview that was taken before the subject went into Stage One EEG. This situation arose several times and was due either to the way that the original protocol of the study had been set up, i.e to remove the subject from bed after 25 minutes if they had not reached Stage 1 sleep yet. During the nap opportunity, the subject lay in the darkened room for 25 minutes and simply did not fall asleep, (reach stage One EEG). There were numerous cells in which there were no reports and therefore these subjects were not included in the statistical analysis for several of the comparisons.

### **Rating of Mentation Reports**

There were a total of 234 mentation reports rated by the three raters, two raters being blind to experimental condition, subject and design and the third rater, the author, blind to experimental condition. The reports of each subject were rated as a set, with each of the rating scales applied separately. The following scales were applied to the raw mentation reports. A detailed

description of each of the scales is provided in Appendix B.

- a. The five subscales of the Absorption in Mentation [AIM] scale that had been previously shown to be sensitive to phasic events (Weinstein, Schwartz & Ellman 1988,1991): (1) Reality (7 point Likert); (2) Affect (7 point Likert); (3) Grammatical Self-Reflection (dichotomous); (4) Temporal (dichotomous); (5) Global Immersion (dichotomous).
- b. Foulkes and Pope's (1973) scale of (6) Sensory (5 point Likert) prominence in the reported dream.
- c. Several subscales from the Psycholinguistic Coding Manual (Antrobus et al., 1977): (7) Total Content Count [TCC] (word count of meaningful informational content); (8) Self-Participation (count of references to self as a participant in the dream).
- d. Foulkes' (1966) (9) Dreamlike Fantasy [DF] scale which is an 8-point scale that indexes increasing dreamlikeness based on dimensions of bizarreness, hallucinatory quality, and recall.
- e. Ratings of (10) Clearness (5 point Likert) and (11) Vividness (5 point Likert) based on the responses to the third question in the inquiry, "How clear and vivid did it seem?".
- f. Ratings of (12) Self-Observing (5 point Likert) as to how much the subject was observing themselves

(13) Self-View (dichotomous) as to whether the subject viewed himself/herself as if they were another person.

Thus a total of 13 ratings were made by each of the judges of each dream report.

### **Training of Judges**

Training of judges was done in group training sessions led by the author. A set of mentation reports were assembled from the training materials that accompanied the Psycholinguistic Coding Manual (Antrobus et al., 1977) as well as reports that had been collected under the protocol of the current study but had been eliminated because the subject dropped out after the first night. The raters trained on these scales until a Pearson correlation of at least  $r = .70$  was achieved between judges on a set of 30 test mentation reports.

The author was qualified to carry out the training because he had himself been trained in the use of the AIM scale by Lissa Weinstein, one of the primary developers of the scale. The correlations of ratings between the author and Dr. Weinstein which constituted the reliability of the prior training sessions were approximately  $r = .80$ . However, the use of the AIM scale in the current study was modified in several ways from that of Weinstein, Schwartz and Ellman (1988, 1991) as well as that of Tunney (1992). Most importantly, in the current study, the judgements by

the raters are made from their own point of view as to what the subjects were experiencing. This was done of necessity because of the nature of the phrasing of the questions used to elicit the mentation reports. For instance, whereas the probe used to elicit the responses in prior studies with the AIM scales specifically asked subjects "How real did it seem?" and "What feelings or emotions did you have?", the current study did not have such probes. In prior studies the Reality Subscale and the Affect Subscale were applied to the subject's responses to these particular questions. In the present study, these subscales are applied to the report as a whole and are judgements made from the point of view of the judges not the subjects.

#### **Reliability of ratings**

The reliability of ratings was assessed in two ways. Initially the reliability was assessed using Pearson and tetrachoric correlations between the three raters in the study as had been employed by Schwartz (1979) and Weinstein (1981). These are presented in Table 2. The correlations in the parentheses are those obtained after all the ratings had been completed. Since these were rather low, a method was devised to improve the reliability of these scores. The judges were retrained by reviewing the scales together and discussing problems that they had making their ratings. Then, instances of widely diverging ratings were re-

submitted to the judges, and they re-rated the reports. The Pearson correlations were again assessed and the results are also in Table 2 without parentheses. It is clear that the retraining was helpful in improving the similarity of the ratings across the three judges.

The reliabilities of the Clear and Vivid scales were above  $r = .70$  without any retraining. These scales were included in part because of the issue of how the way the probes were worded affected the reliability of the raters as well as the outcomes of the planned comparisons. These scales are rated based on the subjects own point of view, as opposed to the judges point of view. This is possible because of the wording of the third probe: "How clear and vivid did it seem to you?" This was asked directly of the subjects and the Clear and Vivid scales were easier to score reliably as a result. While this is a minor methodological point, it would seem that the failure to replicate Weinstein's work can be attributed in part to such methodological inconsistencies between the current study and prior studies with the AIMS.

Table 2 - Pearson and Tetrachoric Correlation Coefficients for Interrater Reliabilities

|                | Pearson correlation coefficient for Likert-Type scales |              |              |
|----------------|--|--------------|--------------|
|                | Raters 1 & 2   | Raters 2 & 3 | Raters 1 & 3 |
| Reality        | .85 (.59)  | .85 (.50)    | .81 (.37)    |
| Affect         | .78 (.51)  | .82 (.61)    | .82 (.54)    |
| Sensory        | .82 (.70)  | .86 (.73)    | .82 (.77)    |
| Self Observing | .79 (.49)  | .82 (.62)    | .72 (.71)    |
| Clear          | .80  | .70          | .70          |
| Vivid          | .82  | .83          | .84          |
| Dreamlike Fant | .83 (.62)  | .84 (.78)    | .81 (.71)    |
|                | Pearson correlation of content count                   |              |              |
| Total Content  | .92  | .95          | .93          |
|                | Pearson correlation coefficients of dichotomous scales |              |              |
| Global         | .71 (.42)  | .58 (.28)    | .64 (.27)    |
| Grammat Self   | .67 (.34)  | .67 (.80)    | .58 (.43)    |
| Temporal       | .25  | .29          | .27          |
| Self View      | .60 (.40)  | .51 (.37)    | .64 (.65)    |
|                | Tetrachoric correlations of dichotomous scales         |              |              |
| Global         | .70  | .85          | .80          |
| Grammat Self   | .87  | .80          | .87          |
| Temporal       | .57  | .60          | .59          |
| Self View      | Not computed, frequencies differ < 90%-10%             |              |              |

*Note: Pearson r's in parentheses are results of first correlations prior to retraining of judges.*

### **Intraclass Correlation Coefficient**

While the prior studies of the AIM scale have generally used two raters, the current study employed three raters. An additional approach was employed to assess the reliability of multiple raters that was more appropriate to the design of the present study. This involved assessing the Intraclass Correlation Coefficient [ICC]. The reliabilities for the 13 scales based on the ICC is provided in Table 3. The use of intraclass correlations in assessing interrater reliability has been discussed by Shrout and Fleiss (1979) who define this statistic as a ratio of the variance of interest over the sum of the variance of interest plus error. These writers have given guidelines for choosing among numerous versions of the ICC. As they point out, in a typical interrater reliability study, each of a random sample of  $N$  targets (in this case 234 mentation reports) is rated independently by  $k$  judges (in this case three judges.) These writers discuss three different cases of this kind of study:

(A) Each target is rated by a different set of judges, randomly selected from a larger population of judges.

(B) A random sample of judges is selected from a larger population, and each judge rates each target.

(C) Each target is rated by each of the same

judges, who are the only judges of interest.

Each kind of study requires a separately specified mathematical model to describe its results. While the present study is not primarily a reliability study, it is important to note that the model that should be employed here is the second case (B) above. This is because we assume that we are randomly selecting the judges from a population of clinically sensitive judges, and we are interested in generalizing our findings to other single judges, despite the fact that ultimately we used means of the judges ratings to do our experimental analyses. We would like to be able to say that our rating scales can be used effectively by a variety of judges. In the current study, our reliability study preceded a substantive study in which each judge was responsible for rating his or her own random sample of targets. In this case a Target X Judges two-way ANOVA is the appropriate mode of analysis. This analysis partitions the within-target sum of squares into a between-judges sum of squares (judges mean squares [JMS]) and a residual sum of squares (error mean squares [EMS]). Because the effect of judges is the same for all targets in the present study, interjudge variability does not affect the expectation of the between targets variance. The appropriate formula for estimated reliability coefficient for this situation is given in the note at the bottom of Table 3. The calculations for these ICCs were made by

pocket computer after obtaining the Mean Squares obtained from a univariate, 2-factor ANOVA subroutine of SPSS-PC RELIABILITIES program. The two factors were Reports (rows) X Raters (columns).

Table 3 - Intraclass Correlations (ICC) and Mean Squares (MS) used for Interrater Reliability for three judges ( $k = 3$ ) and 234 target reports ( $n = 234$ )

|              | Between Targets<br>BMS | Within Target<br>WMS | Between Judges<br>JMS | Error<br>EMS | ICC |
|--------------|------------------------|----------------------|-----------------------|--------------|-----|
| Reality      | 8.949                  | 0.571                | 2.881                 | 0.561        | .83 |
| Affect       | 5.328                  | 0.460                | 15.583                | 0.395        | .78 |
| Sensory      | 5.937                  | 0.381                | 2.600                 | 0.372        | .83 |
| Clear        | 5.900                  | 0.383                | 0.895                 | 0.381        | .83 |
| Vivid        | 6.041                  | 0.381                | 0.758                 | 0.380        | .83 |
| SelfObserv   | 4.927                  | 0.487                | 12.374                | 0.436        | .75 |
| Global       | 7.720                  | 0.087                | 0.130                 | 0.087        | .97 |
| GrammSelf    | 7.810                  | 0.087                | .038                  | .087         | .97 |
| Temporal     | 7.990                  | 0.084                | 0.040                 | 0.084        | .97 |
| SelfView     | 8.065                  | 0.023                | .130                  | .022         | .99 |
| TotalCont    | 4834.3                 | 119.20               | 1691.8                | 112.4        | .92 |
| SelfParticip | 3.480                  | 0.304                | 1.608                 | .299         | .78 |
| DreamFant    | 11.799                 | 0.681                | 1.377                 | 0.678        | .84 |

*Note: Formula used to compute these ICCs is appropriate for a random sample of judges each of whom rates each target as presented in Shrout & Fleiss (1979):*

$$ICC = \frac{BMS - EMS}{BMS + (k - 1)EMS + k(JMS - EMS)/n}.$$

*This is based on a statistical model which allows for a generalization of findings to randomly selected judges.*

### Design of analysis

The experimental design was laid out in such a way as to address certain predictions made from Ellman & Weinstein's interpretation of the phasic-tonic model within the constraints of the data and power of the study.

We arranged the set of mentation reports in two basic experimental designs outlined in Figure 2 and Figure 3 which allowed a series of three planned comparisons and three post hoc comparisons that were derived from an interpretation of the phasic-tonic model advanced by Ellman & Weinstein (1991). Our objective was to attempt to replicate certain specific comparisons regarding REM deprivation and nocturnal REM period mentation as well as attempting to demonstrate the effects of REM deprivation on daytime Sleep Onset mentation. Rather than conducting an omnibus ANOVA on these cells, a series of planned comparisons were conducted.

|                                    | PRE-<br>DEPRIVATION<br>DAYTIME<br>SLEEP ONSET | POST-<br>DEPRIVATION<br>DAYTIME<br>SLEEP ONSET | REM PERIOD<br>NOCTURNAL<br>REPORTS<br>(3 nights) |
|------------------------------------|---|--|--|
| Type of REM (n = 8)<br>Deprivation | (cell 1)                                      | (cell 2)                                       | (cell 3)   |
| Stage 2/NREM (n = 7)               | (cell 4)                                      | (cell 5)                                       | (cell 6)   |

*Figure 2 - Design for basis of first set of planned, orthogonal comparisons*

The first design includes all the reports in a two-factor, between subjects design, illustrated in Figure 2. The rows factor, Type of Deprivation, is between subjects,

with two conditions, REM Deprivation and Stage 2 Deprivation. The other factor, Sleep condition, is within-subjects, and has three levels. While it can be simply viewed as a series of discrete categories, we assume that these are conditions of increasing likelihood of phasic events, thus permitting us to test hypotheses regarding the effects of phasic events on sleep mentation.

In broadest terms, the model holds that sleep mentation following phasic events ought to demonstrate greater Absorption In Mentation. For this design there were three planned, orthogonal comparisons made. They are described below along with the rationale for the predictions as derived from prior findings reported in Weinstein, Schwartz & Ellman (1991) and the theoretical considerations in Ellman & Weinstein (1991).

For this design then, there were three planned, orthogonal comparisons of interest.

1) Pre-REM deprivation Daytime Sleep Onset (cell 1) with Post-REM Deprivation (cell 2). There has been no specific study of the sensitivity of the AIM scales to Daytime Sleep Onset mentation, and so our predictions were based on the model advanced by Ellman and Weinstein (1991). For those AIM scales which were sensitive to discriminating phasic from tonic reports in the past, there should be significantly greater absorption in mentation. Thus, Reality, Affect, Temporal, Self-representation and Global scale would show means higher following REM Deprivation. The model also predicts an increase in the Sensory and Self-observing scales. The model would predict no differences in Total Content and no differences in Clear and Vivid scales.

2) Pre Stage 2 Deprivation Daytime Sleep Onset (cell 4) with Post Stage 2 Deprivation (cell 5) with the

prediction that since there is less REM pressure, less likelihood of phasic events, that there will be no significant differences in the AIMS scales. One serious methodological flaw with this comparison was the lack of independent measure of phasic event during sleep onset.

3) The third planned comparison was between REM mentation reports under conditions of REM deprivation (cell 3) with REM reports during Stage 2 deprivation with greater absorption predicted in mentation under REM deprivation. In this instance, we had an opportunity to attempt to replicate the Weinstein (1981) finding that the Reality subscale was sensitive to discriminating between REM period, phasic reports under REM deprivation vs the REM period, phasic reports under Stage 2 deprivation. She also reported that the Sensory scale showed greater sensory elements following REM deprivation than following Stage 2. Again, the AIM scales should be higher for REM deprived subjects than the Stage 2 deprived subjects while Total Content Count and Clear and Vivid scale would not be sensitive to the difference.

Although we expected the treatment effects to be slight for all the comparisons, and would have preferred to have controlled for individual differences with a fully balanced, within subjects design, the constraints of the overall study prohibited this. These constraints were primarily financial as it was impossible to get subjects to return to the laboratory for another set of deprivation nights. This clearly diminished the power of this study.

| Type of Deprivation and n of subjects | REM MENTATION DEPRIVATION NIGHT 1 | REM MENTATION DEPRIVATION NIGHT 2 | REM MENTATION RECOVERY NIGHT |
|---------------------------------------|-----------------------------------|-----------------------------------|------------------------------|
| REM DEP (n = 4)                       | (cell 1)                          | (cell 2)                          | (cell 3)                     |
| NonREM Stage 2 DEP (n = 4)            | (cell 4)                          | (cell 5)                          | (cell 6)                     |

*Figure 3 - Design for basis of set of post hoc comparisons using only nocturnal mentation*

A second design which used only the nocturnal REM mentation, is illustrated in Figure 3. By breaking down the total set of nocturnal reports into the three nights we could look at comparisons which would be of interest in light of finding of Weinstein et. al. In so far as the reports are exclusively REM reports, the design of this analysis more closely repeats the experiment that Weinstein (1981) reports in which she demonstrated the effects of REM deprivation on mentation. Since most of her findings were concerned with phasic events in NonREM Stage 2 sleep this study does not specifically allow us to replicate her work because the reports in the present study are all taken from REM periods. Furthermore, since her findings emerged with the analysis individual differences (Guilty Daydreaming as a blocking factor), the current design is inadequate to address these findings or attempt to replicate them exactly. However, the following comparisons were examined based on the general model we have been dealing with:

4) REM Deprivation Night 1 (cell 1) with REM Deprivation Night 2 (cell 2). The means for the AIMS scale ought to be higher for Night 2 as compared to night one because of the increased intensity of phasic events following two nights of REM deprivation as compared to one.

5) Stage 2 Deprivation Night 1 (cell 3) with Stage 2 Deprivation Night 2 (cell 4). Here we would predict no difference on the AIMS scale due to the relatively less intense effects of Stage 2 deprivation in creating increased REM pressure and increased likelihood of phasic events.

6) Recovery Night from REM deprivation (cell 3) with Recovery Night from Stage 2 deprivation (cell 6). In this comparison there is an opportunity to attempt to replicate the paradoxical findings that for REM mentation on Recovery Nights, the Global and the Self-Representation scale were much less involving after REM deprivation than after Stage 2 deprivation. This was only true for the more introspective reporters (i.e. those who acknowledged greater degree of Guilty Daydreaming) and so an exact replication is not possible. However REM phasic mentation following REM deprivation was rated as less sensory than that following Stage 2, and this was true for all subjects in Weinstein's study.

These designs and the contrasts that have been extracted from them have used subjects as the unit of analysis rather than reports. As can be seen, the n's for the planned comparisons were considerably fewer than the total number of subjects who participated in the study. This is because of the "no reports" which caused several of the subjects to be eliminated from the analysis by the REPEATED MEASURES program of SPSSPC.

The planned, orthogonal comparisons were extracted from the REPEATED MEASURES subprogram of SPSS-PC. This subprogram is actually designed for multivariate analysis,

while the current analysis is conducted such that we have 13 separate univariate designs.

## Chapter IV

### Results

Before reporting on the more substantive experimental results, a brief outline of the subject's demographics will be presented. The procedures for the recruitment of subjects is presented in Appendix A along with other aspects of the host study. A total of 18 subjects were begun in the laboratory protocol, 16 subjects completed the entire protocol. In the REM deprivation group there were a total of eight subjects, seven females and one male, with a mean age of 26.9 years (s.d. 6.1 years). In the Stage 2 deprivation group there were a total of eight subjects, five females and 3 males with a mean of 24.2 years (s.d. of 4.0 years).

Sixteen subjects produced a total of 234 mentation reports. All reports were rated by all three judges on all scales. Two of the judges were blind to experimental condition, subject and design. The third judge was blind to experimental condition of the reports as he was judging them, although he was aware of the design of the study. All of the reports and all of the subjects were utilized in the reliability procedures described in the prior Methods chapter.

As outlined in the prior chapters, for purposes of the

experimental analysis, the data were organized into two 3 X 2 repeated measures designs, one which included all the Daytime Sleep Onset and Nocturnal REM reports and the other which included just the Nocturnal REM reports. The SPSS MANOVA procedure was employed to extract simple (non-multivariate) contrasts with the unit of analysis being subjects. The analysis was based on averages of the subjects' scores within a given cell. As indicated in the prior chapter certain subjects were dropped from the analyses either because they provided no reports in one of the cells, they did not fall asleep at all during Daytime Sleep Onset, i.e. their sleep onset latency was greater than 25 minutes.

In the following analyses each subscale of the AIM scale as well as the other mentation rating scales is treated separately. The first two tables will present means and standard deviations for each condition or cell of the two designs. The next six tables present the results of the six planned, orthogonal contrasts on each of the 13 scales. Table 4 presents the means and standard deviations for each of the 13 scales applied to all the reports, both Daytime Sleep Onset and Nocturnal REM. This corresponds to the analysis described in Figure 2 in the preceding chapter. Each row in Table 4 actually represents a six-cell sub-matrix based on the scale named in the first column. The following table, Table 5, is organized in a similar fashion,

however the means and standard deviations are derived from Nocturnal REM reports, as broken down into the three nights, Night 1-Deprivation, Night 2-Deprivation, Recovery Night.

Table 4 - Means and Standard Deviations of Awakening Condition by Deprivation Group (3 X 2, Within/Between) for all reports.

| Scale<br>(range)    | REM Deprivation<br>Group (7 subjects) |                           |                     | Stage 2 Deprivation Group<br>(7 subjects) |                           |                     |
|---------------------|---------------------------------------|---------------------------|---------------------|---|---------------------------|---------------------|
|                     | Pre SO<br>Daytime<br>n=8              | Post SO<br>Daytime<br>n=8 | REM<br>Noct.<br>n=8 | Pre SO<br>Daytime<br>n=7                  | Post SO<br>Daytime<br>n=7 | REM<br>Noct.<br>n=7 |
| Reality<br>(1-7)    | 3.89<br>(1.01)                        | 3.75<br>(0.89)            | 4.37<br>(0.83)      | 4.43<br>(0.48)                            | 4.38<br>(1.31)            | 4.73<br>(.68)       |
| Affect<br>(1-7)     | 1.55<br>(0.57)                        | 1.58<br>(0.70)            | 1.73<br>(0.52)      | 1.66<br>(0.68)                            | 1.63<br>(0.54)            | 1.79<br>(.56)       |
| GramSelf<br>(0-1)   | 0.31<br>(0.31)                        | 0.43<br>(0.21)            | 0.50<br>(0.20)      | 0.38<br>(0.25)                            | 0.44<br>(0.20)            | 0.64<br>(.20)       |
| Temporal<br>(0-1)   | 0.13<br>(.31)                         | 0.08<br>(0.09)            | 0.09<br>(.17)       | 0.10<br>(0.14)                            | 0.15<br>(0.19)            | 0.11<br>(.14)       |
| Global<br>(0-1)     | 0.27<br>(0.20)                        | .41<br>(.17)              | .65<br>(.20)        | .36<br>(.30)                              | .40<br>(.26)              | .52<br>(.22)        |
| Sensory<br>(1-5)    | 2.76<br>(0.63)                        | 2.36<br>(0.49)            | 2.75<br>(0.89)      | 2.77<br>(0.86)                            | 2.90<br>(0.97)            | 2.41<br>(.50)       |
| SelfObs.<br>(1-5)   | 2.28<br>(0.75)                        | 2.64<br>(0.66)            | 2.64<br>(0.83)      | 2.66<br>(0.37)                            | 2.46<br>(0.85)            | 2.46<br>(.62)       |
| SelfView<br>(0-1)   | .01<br>(.03)                          | .08<br>(.13)              | .02<br>(.06)        | .06<br>(.18)                              | .10<br>(.12)              | .07<br>(.07)        |
| Clear<br>(1-5)      | 2.92<br>(0.61)                        | 2.84<br>(0.84)            | 3.19<br>(0.59)      | 3.45<br>(0.66)                            | 2.75<br>(1.11)            | 2.72<br>(.92)       |
| DreamFan<br>(0-7)   | 5.46<br>(1.35)                        | 5.88<br>(0.78)            | 5.79<br>(1.55)      | 5.63<br>(0.77)                            | 5.77<br>(1.37)            | 6.11<br>(.81)       |
| TotalCon<br>(0-246) | 26.20<br>(14.55)                      | 32.61<br>(15.67)          | 46.40<br>(41.2)     | 30.32<br>(17.28)                          | 34.93<br>(19.66)          | 41.58<br>(31.9)     |
| SelfPart<br>(0-7)   | 0.49<br>(0.61)                        | 0.64<br>(0.56)            | 0.89<br>(0.74)      | 0.45<br>(0.31)                            | 0.35<br>(0.39)            | 0.73<br>(.20)       |
| Vivid<br>(1-5)      | 2.93<br>(0.67)                        | 2.96<br>(0.62)            | 3.36<br>(0.67)      | 3.45<br>(0.66)                            | 3.09<br>(1.06)            | 2.82<br>(.77)       |

Table 5 - Means and Standard Deviations (in parentheses) of Night by Deprivation Group (3 X 2, Within/Between) for nocturnal REM reports.

| Scale<br>(range)    | REM Deprivation<br>Group (7 subjects) |                           |                         | Stage 2 Deprivation Group<br>(6 subjects) |                           |                         |
|---------------------|---------------------------------------|---------------------------|-------------------------|---|---------------------------|-------------------------|
|                     | Night 1<br>Depriv.<br>n=7             | Night 2<br>Depriv.<br>n=7 | Night3<br>Recov.<br>n=7 | Night 1<br>Depriv.<br>n=6                 | Night 2<br>Depriv.<br>n=6 | Night3<br>Recov.<br>n=6 |
| Reality<br>(1-7)    | 4.00<br>(1.60)                        | 5.07<br>(0.78)            | 4.73<br>(1.06)          | 4.75<br>(1.21)                            | 4.14<br>(1.44)            | 4.77<br>(.92)           |
| Affect<br>(1-7)     | 2.29<br>(0.57)                        | 1.57<br>(0.25)            | 2.21<br>(1.39)          | 2.44<br>(1.54)                            | 1.44<br>(0.42)            | 1.64<br>(0.78)          |
| GramSelf<br>(0-1)   | 0.62<br>(0.36)                        | 0.71<br>(0.23)            | 0.38<br>(0.30)          | 0.56<br>(0.27)                            | 0.78<br>(0.29)            | 0.50<br>(0.41)          |
| Temporal<br>(0-1)   | 0.07<br>(0.13)                        | 0.12<br>(0.18)            | 0.24<br>(0.21)          | 0.44<br>(0.29)                            | 0.05<br>(0.14)            | 0.08<br>(0.14)          |
| Global<br>(0-1)     | 0.71<br>(0.39)                        | 0.67<br>(0.35)            | 0.69<br>(0.20)          | 0.53<br>(0.27)                            | 0.53<br>(0.45)            | 0.56<br>(0.36)          |
| Sensory<br>(1-5)    | 2.97<br>(1.31)                        | 3.14<br>(1.11)            | 3.00<br>(0.98)          | 3.17<br>(0.81)                            | 2.11<br>(1.20)            | 2.50<br>(0.69)          |
| SelfObs.<br>(1-5)   | 2.57<br>(1.14)                        | 2.90<br>(1.08)            | 3.45<br>(1.00)          | 2.91<br>(1.08)                            | 1.78<br>(0.65)            | 2.16<br>(0.71)          |
| SelfView<br>(0-1)   | 0.07<br>(0.19)                        | 0.00<br>(0.00)            | 0.07<br>(0.19)          | 0.22<br>(.29)                             | 0.05<br>(0.13)            | 0.00<br>(.00)           |
| Clear<br>(1-5)      | 3.43<br>(1.09)                        | 3.48<br>(1.04)            | 3.00<br>(0.69)          | 3.31<br>(1.05)                            | 2.36<br>(1.27)            | 3.25<br>(1.11)          |
| DreamFan<br>(0-7)   | 5.90<br>(1.87)                        | 6.64<br>(1.58)            | 6.52<br>(1.46)          | 6.66<br>(1.15)                            | 5.42<br>(1.65)            | 6.69<br>(0.98)          |
| TotalCon<br>(0-246) | 48.78<br>(65.67)                      | 43.90<br>(25.32)          | 51.42<br>(43.2)         | 52.42<br>(26.21)                          | 23.75<br>(20.16)          | 46.63<br>(23.7)         |
| SelfPart<br>(0-7)   | 0.55<br>(0.58)                        | 0.67<br>(0.47)            | 1.31<br>(1.48)          | 0.83<br>(1.11)                            | 0.47<br>(0.41)            | 1.10<br>(1.26)          |
| Vivid<br>(1-5)      | 3.38<br>(1.17)                        | 3.28<br>(1.28)            | 2.95<br>(0.58)          | 3.19<br>(1.13)                            | 2.47<br>(1.11)            | 3.30<br>(1.14)          |

Each scale was analyzed separately with six planned, orthogonal comparisons of mean ratings; the specific choices made for the comparisons was based on prior findings with the AIM scales as reported in Weinstein & Ellman (1991). These comparisons were conducted in order to address two general research questions:

Question 1: Does REM deprivation result in greater Absorption in Mentation during REM sleep?

Question 2: Does REM deprivation result in greater Absorption in Mentation during Daytime Sleep Onset?

There were very few statistically significant results among these planned comparisons. Nevertheless, we will describe the results of each of the six planned orthogonal contrasts as they appear in Table 6 to Table 11.

#### **Question One: REM Deprivation and Nocturnal REM Mentation**

As the main purpose of this study was to attempt to replicate some of the findings of Weinstein, Schwartz & Ellman (1988, 1991) we will first address the question "Does REM deprivation result in greater Absorption in Mentation during REM sleep?" Four contrasts were examined with regard to Nocturnal REM sleep and the comparisons of means on all the scales are presented in Table 6 to Table 9.

(Contrast 1) Table 6 presents the contrasts for each scale that were obtained from the REPEATED MEASURES subprogram of the SPSS-PC statistical analysis program. These contrasts are based on means and standard deviations presented in Table 4, in the third and sixth column. It was predicted that Nocturnal REM reports under conditions of REM deprivation and Recovery would show greater Absorption in Mentation as compared to the REM reports under conditions of NREM/Stage 2 deprivation. In terms of the specific scales, the Reality, Affect, Grammatical Self-Representation, Temporal and Global Absorption scales were predicted to be greater under conditions of REM deprivation as opposed to Stage 2- nonREM deprivation. No significant F values were achieved for these contrasts nor for any of the other scales. This is the contrast with the greatest number of reports employed and is a between groups contrast.

Table 6 - Contrast One: Simple effects of planned contrast of Nocturnal REM mentation between REM deprived and stage 2 deprived groups (between subjects).

|            | Hypoth<br>MS<br>df=1 | Error<br>MS<br>df=13 | F    | sig of<br>F |
|------------|----------------------|----------------------|------|-------------|
| Reality    | 0.50                 | 0.60                 | .83  | .38         |
| Affect     | 0.01                 | 0.31                 | .04  | .853        |
| Sensory    | 0.37                 | 0.54                 | .67  | .427        |
| Clear      | 0.85                 | 0.58                 | 1.47 | .247        |
| Vivid      | 1.06                 | 0.52                 | 2.04 | .177        |
| SelfObserv | 0.13                 | 0.55                 | 0.23 | .643        |
| Global     | 0.07                 | 0.04                 | 1.46 | .248        |
| GrammSelf  | 0.08                 | 0.04                 | 1.84 | .198        |
| Temporal   | 0.02                 | 0.02                 | 1.52 | .239        |
| SelfView   | 0.01                 | 0.00                 | 1.88 | .193        |
| TotalCont  | 413.55               | 1069.44              | 0.39 | .545        |
| SelfPart   | 0.10                 | 0.31                 | 0.33 | .577        |
| DreamFant  | 0.38                 | 1.60                 | 0.24 | .634        |

Three more post hoc comparisons were made regarding the effects of REM deprivation on Nocturnal REM mentation. The following comparisons were based on the means and standard deviations presented in Table 5, which included only Nocturnal REM reports under differing deprivation conditions.

(Contrast 2) REM reports on the second night of REM Deprivation would show a greater Absorption in Mentation as compared to the first night of deprivation. Table 7 presents the results of the contrasts for each scale based on the means and standard deviations presented in columns one and two of Table 5. As can be seen, there were no significant contrasts. Again we were predicting that there would be greater values on the AIM scales, while the other scales would be unaffected by REM deprivation.

(Contrast 3) A prediction closely related to the previous one is that REM reports on the second night of Stage 2/NREM deprivation would show no differences in Absorption in mentation as compared to the first night of Stage 2/NREM deprivation. The means and standard deviations for these comparisons are found in columns four and five of Table 5. The contrasts for all the scales are presented in Table 8. As can be seen in

Table 8, there were two significant F values achieved. This finding is inconsistent with the prediction that there would be no significant effects of the restriction of Stage 2/NonREM sleep. This contrast was to have been the control comparison. Yet there is a decrease in the means for the Temporal subscale (Night 1, mean = 0.44 and Night 2, mean = 0.05 presented in Table 5). The contrast is statistically significant ( $F=19.15$ ,  $df$  1 and 11,  $p = .001$ ). However, it should be noted that the distribution for this dichotomous scale was very positively skewed, and the meaning of any significant findings with this scale are quite suspect. There was also a significant decrease in the Self Observing subscale from Night 1 to Night 2 of stage 2 NREM deprivation. Table 5 shows that the means for Night 1 and Night 2 are 2.91 and 1.78 respectively. Table 8 indicates that this difference is statistically significant ( $F = 5.49$ ,  $df = 1$  and 11,  $p = .039$ ). It should be noted that these are somewhat isolated and trivial findings, given the gross tendency in this analysis towards non-significant results. It would seem likely not to have some of these comparisons achieve significance as a result of chance associations.

Table 7 - Contrast Two: Simple effects of post hoc comparison of Nocturnal REM periods between Night One and Night Two of REM deprivation (within subjects).

|            | Hypoth<br>MS<br>df=1 | Error<br>MS<br>df=11 | F     | sig of<br>F |
|------------|----------------------|----------------------|-------|-------------|
| Reality    | 1.120                | 1.892                | .591  | .458        |
| Affect     | 1.785                | 1.191                | 1.49  | .246        |
| Sensory    | 0.097                | 1.150                | .084  | .946        |
| Clear      | 0.007                | 1.649                | .004  | .946        |
| Vivid      | 0.031                | 2.01                 | .015  | .902        |
| SelfObserv | 0.388                | 0.708                | .549  | .474        |
| Global     | 0.007                | 0.087                | .090  | .769        |
| GrammSelf  | 0.031                | 0.089                | .353  | .564        |
| Temporal   | 0.007                | 0.023                | .335  | .574        |
| SelfView   | 0.017                | 0.040                | .445  | .518        |
| TotalCont  | 83.38                | 1427.0               | .050  | .813        |
| SelfPart   | 0.391                | 0.528                | .740  | .408        |
| DreamFant  | 1.906                | 1.165                | 1.635 | .227        |

Table 8 - Contrast Three: Simple effects of post hoc comparison of Nocturnal REM periods between Night One and Night Two of Stage 2 deprivation (within subjects).

|            | Hypoth<br>MS<br>df=1 | Error<br>MS<br>df=11 | F     | sig of<br>F |
|------------|----------------------|----------------------|-------|-------------|
| Reality    | 1.120                | 1.892                | .591  | .458        |
| Affect     | 3.00                 | 1.191                | 2.51  | .141        |
| Sensory    | 3.34                 | 1.150                | 2.90  | .116        |
| Clear      | 2.675                | 1.649                | 1.63  | .228        |
| Vivid      | 1.564                | 2.016                | .776  | .397        |
| SelfObserv | 3.89                 | 0.708                | 5.49  | .039*       |
| Global     | 0.000                | 0.087                | .000  | .100        |
| GrammSelf  | 0.148                | 0.089                | 1.65  | .225        |
| Temporal   | 0.453                | 0.023                | 19.15 | .001*       |
| SelfView   | 0.083                | 0.040                | 2.08  | .177        |
| TotalCont  | 2422.5               | 1427.0               | 1.69  | .219        |
| SelfPart   | 0.049                | 0.528                | .093  | .765        |
| DreamFant  | 4.68                 | 1.165                | 4.025 | .070        |

Note: Cells with asterisks indicate significant contrasts with probabilities at  $p = .05$  or less.

The prior two sets of contrasts were not specific replications of prior experimental findings but were made in order to make use of the data in the most efficient and statistically appropriate way. The next and last of the four comparisons which deal with REM deprivation on Nocturnal REM sleep was an attempt to replicate the findings of Weinstein (1981) that there would be a less Absorption in Mentation demonstrated on the Recovery night from REM deprivation for subjects who were less introspective.

(Contrast 4) REM reports on Recovery night from REM deprivation was compared with REM reports on Recovery night from NREM/Stage 2 deprivation. The means and standard deviations for these comparisons are found in columns three and six of Table 5. The contrasts for all the scales are presented in Table 9. Again, there was but one significant F value achieved for Self Observing Scale . The means for this contrast are found in Table 8; the REMD Recovery Night mean was 3.45 and the Recovery Night mean for the Stage 2 deprived group was 2.16 ( $F = 6.83$ ,  $df = 1$  and  $11$ ,  $p = .024$ ). Our findings could not fully address this hypothesis because the previous findings (Weinstein 1981) were based on including a blocking factor for the individual differences. When the same blocking factor was applied to the present data set, the number of subjects in the cell was too small to test the hypothesis.

Table 9 - Contrast Four: Simple effects of post hoc comparison of Nocturnal REM periods on Recovery Night between REM deprived and Stage 2 deprived subjects (between Ss).

|            | Hypoth<br>MS<br>df=1 | Error<br>MS<br>df=11 | F    | sig of<br>F |
|------------|----------------------|----------------------|------|-------------|
| Reality    | 0.010                | 1.00                 | .010 | .994        |
| Affect     | 1.07                 | 1.33                 | 0.80 | .390        |
| Sensory    | 0.81                 | 0.740                | 1.09 | .319        |
| Clear      | 0.20                 | 0.82                 | 0.25 | .630        |
| Vivid      | 0.40                 | 0.78                 | 0.52 | .487        |
| SelfObserv | 5.34                 | 0.78                 | 6.83 | .024*       |
| Global     | 0.080                | 0.060                | 0.72 | .413        |
| GrammSelf  | 0.050                | 0.120                | 0.37 | .557        |
| Temporal   | 0.080                | 0.030                | 2.32 | .156        |
| SelfView   | 0.020                | 0.020                | 0.85 | .377        |
| TotalCont  | 72.12                | 1274.5               | 0.06 | .814        |
| SelfPart   | 0.65                 | 1.67                 | 0.39 | .545        |
| DreamFant  | 0.09                 | 1.61                 | 0.06 | .813        |

Note: Cell with asterisk indicates a significant contrast with a probability of less than  $p = .05$ .

Thus, there was an extraordinarily uniform outcome of the analysis of this question: to wit, the current analysis did not demonstrate the effects of REM deprivation on REM sleep.

#### **Question Two: Daytime Sleep Onset and REM Deprivation**

The effect of REM Deprivation on Daytime Sleep Onset has not been specifically addressed in the literature, although a recent study (Tunney, 1992) has utilized a different data set and addressed the effects of REM Deprivation on Nocturnal Sleep Onset. The last two planned contrasts in this experiment addressed the question: Does REM deprivation effect Daytime Sleep Onset Mentation? The logic behind these comparisons is similar to that which ties together Contrast 2 and Contrast 3 above. If we could demonstrate a change, specifically an increase, in Absorption in Mentation in the Daytime Sleep Onset reports following REM deprivation and not following Stage 2-NonREM deprivation, then there would be evidence of the specific sensitivity of the AIM scales to REM deprived mentation.

(Contrast 5) Our prediction was that based on the increased REM pressure during the day following two nights of REM deprivation, there would be greater Absorption in Mentation seen in the Daytime Sleep Onset

mentation following REM Deprivation. The means and standard deviations for the following contrast are presented in column one and two of Table 4. The results of the contrasts of for all the scales are presented in Table 10. There were no significant F values achieved for any of the scales.

(Contrast 6) Table 11 presents the results of the contrasts Daytime Sleep Onset Reports following Stage 2-NonREM deprivation. The means and standard deviations for these contrasts are presented in columns four and five of Table 4. Again, there were no significant F values achieved. This result would have been meaningful had there been a difference for the REM deprivation condition as it would have served as a control condition.

Thus, the experimental analysis failed to demonstrate any greater Absorption in Mentation in Daytime Sleep Onset mentation following REM deprivation.

Table 10 - Contrast Five: Simple effects of planned comparison of Daytime Nap Onset Pre vs Post REM deprivation (within subjects).

|            | Hypoth<br>MS<br>df=1 | Error<br>MS<br>df=13 | F     | sig of<br>F |
|------------|----------------------|----------------------|-------|-------------|
| Reality    | 0.022                | 0.676                | .032  | .859        |
| Affect     | 0.004                | 0.366                | .011  | .916        |
| Sensory    | 0.646                | 0.664                | .973  | .343        |
| Clear      | 0.025                | 0.426                | .059  | .811        |
| Vivid      | 0.003                | 0.379                | .009  | .924        |
| SelfObserv | 0.533                | 0.288                | 1.85  | .197        |
| Global     | 0.075                | 0.031                | 2.40  | .145        |
| GrammSelf  | 0.049                | 0.040                | 1.216 | .290        |
| Temporal   | 0.010                | 0.008                | 1.81  | .297        |
| SelfView   | 0.021                | 0.005                | 3.93  | .069        |
| TotalCont  | 164.65               | 139.99               | 1.176 | .298        |
| SelfPart   | 0.094                | 0.132                | 0.710 | .415        |
| DreamFant  | 0.710                | 1.227                | 0.558 | .468        |

Table 11 - Contrast Six: Simple effects of the planned contrast of Daytime Nap Onset Pre vs Post Stage-2 NonREM deprivation (within subjects).

|            | Hypoth<br>MS<br>df=1 | Error<br>MS<br>df=13 | F     | sig of<br>F |
|------------|----------------------|----------------------|-------|-------------|
| Reality    | 0.009                | 0.676                | .013  | .908        |
| Affect     | 0.002                | 0.366                | .084  | .939        |
| Sensory    | 0.564                | 0.664                | .084  | .775        |
| Clear      | 1.55                 | 0.426                | 3.64  | .079        |
| Vivid      | 0.450                | 0.379                | 1.186 | .296        |
| SelfObserv | 0.136                | 0.288                | 0.474 | .503        |
| Global     | 0.006                | 0.031                | 0.189 | .670        |
| GrammSelf  | 0.010                | 0.040                | 0.258 | .620        |
| Temporal   | 0.008                | 0.008                | 0.974 | .342        |
| SelfView   | 0.005                | 0.005                | 1.06  | .322        |
| TotalCont  | 74.41                | 139.99               | 0.531 | .479        |
| SelfPart   | 0.036                | 0.132                | 0.272 | .611        |
| DreamFant  | 0.069                | 1.227                | 0.054 | .819        |

## Chapter V

### Discussion

The most unique and compelling methodological achievement of the present study was the experimental manipulation of REM sleep deprivation. The procedures for this manipulation are rather specialized and required significant technical training and effort. Thus, in order to make best use of the experimental manipulation afforded by the REM deprivation procedures, research questions were formulated about the effects of REM deprivation on Nocturnal REM mentation and Daytime Sleep Onset mentation. The experimental hypotheses were formulated in such a way as to take advantage of these costly procedures. Since only a limited number of cells could be legitimately compared in planned, orthogonal contrasts, and, given that the basic design of this experiment had already been established (as a function of the "host" study's focus on "sleepiness") it was necessary to select the orthogonal contrasts which would answer the questions most important to the research team.

Thus, we predicted that there would be greater loss of reflective self representation under conditions of greater REM pressure, i.e. following REM deprivation as opposed to nonREM Stage 2 deprivation. We predicted that 1) Nocturnal REM period reports following REM deprivation would show

higher scores on the AIM scales than Nocturnal REM period reports following nonREM-Stage 2 deprivation; 2) Daytime Sleep Onset reports following REM deprivation would show significant change in AIM scale scores over baseline scores while Daytime Sleep Onset reports following nonREM-Stage 2 deprivation would not show this change. A set of post hoc contrasts were examined based on nocturnal mentation reports alone. We looked at there was a change on the second night of deprivation as compared to the first night. We also looked at whether Recovery night REM reports following REM deprivation would show higher scores than Recovery night REM reports following nonREM-Stage 2 deprivation;

With the exception of three, isolated significant comparisons, the vast majority of the contrasts were not significant. None of the hypotheses of this study were supported by the results of the planned, orthogonal contrasts which were tested or by the post hoc comparisons. The discussion below addresses some of the possible reasons for this and suggests some further analyses.

### **Limitations of the Data Set and Evaluation of the Predictions**

Prior studies which have reported on the development of the AIM scale (Weinstein, Schwartz & Ellman, 1988, 1991; Tunney, 1992; Krech, 1993) have all utilized a single data set of sleep mentation reports as well as similar

methodologies and measures in order to be internally consistent and to ensure the validity of inter-study comparisons. While the current study is related to these studies in its objective of further exploration of suspension of reflective self-representation in sleep mentation, the data set, i.e the reports, the design, the measures, are different. While this limits inter-study comparisons, it does allow, in principle, for the evaluation of the robustness of the phenomena, that is, the association of phasic events with the suspension of reflective self-representation. Yet, the lack of significant findings, at least with respect to the first two comparisons concerned with Nocturnal REM mentation, are inconsistent with Weinstein et al. and fail to replicate their findings. One important question in this regard is whether there were design factors which suggest that this would not constitute a legitimate attempt to replicate.

The present study reports on findings utilizing considerably fewer subjects. Clearly, the lowered N, (only 13 of the 16 subjects actually made it into the repeated measures analysis of nocturnal REM mentation) may have markedly reduced the power of the present study. Weinstein et. al. have reported on data with a larger number of subjects. Furthermore, the unit of analysis in the present study is subjects mean scores whereas Weinstein et. al. utilized reports as a unit of analysis. It should be noted

that an analysis based on reports as a unit of analysis was conducted for the present study and did not find different outcomes.

There may have been significant changes in methodology and design resulting from the attempt to integrate the mentation study with the "host" study that so greatly reduced the statistical power that the effect of REM deprivation on REM mentation was not seen. Because we used a "yoked" design with subjects yoked on sleep variables, i.e. number of awakenings, amount of sleep deprivation, we were essentially unable to directly replicate the conditions which obtained in the studies presented in Weinstein et. al.. We did not have a cross-over design that was counterbalanced for deprivation condition. This was why we chose to make individual planned comparisons based on the model which had been the basis for the prior studies. By looking at the results of these comparisons as a whole we would be able to see the success of the model in predicting outcome. However, there remain other procedural differences which could have lead to the absence of significant differences.

One difference in the methodologies between the present study and the prior studies is the specific questions asked during the inquiry that elicited each report. The probes in the present study did not specifically ask the subjects engaged in on the spot evaluation of their mentation. The

specific questions "How real did it seem?" and "How intense were your feelings?" were not asked in the present study because these questions had been criticized as potentially raising the levels of reflective self-representation and confounding the prior studies. Also, during the planning stages of the laboratory protocol for the overall study, there was concern over the disruption of the subjects sleep pattern if they knew that they would have to be making judgements about the realness or affective quality of their mentation. There was a strong effort made to prevent arousals or other disruption of the sleep onset pattern as the single most important criterion of the "sleepiness" study was sleep onset latency. While this latter point is more of an excuse than an explanation, the fact remains that questions that call for self-reflection would be likely to influence levels of suspension of self-representation. Yet this change in procedure could contribute to the outcome of this study.

To some extent, the failure to demonstrate effects of REM deprivation on REM mentation without the interaction of individual differences is not inconsistent with Weinstein et al. and the Arkin et al. findings. Given the absence of a true counter-balanced design in the present study, any findings regarding individual differences would be irrelevant. We make our most interesting predictions that were permitted by the existing design and that would reflect

on the particular interpretation of the phasic-tonic model of sleep mentation advanced by Ellman and Weinstein (1991). As was indicated above, there were no significant findings in any of the separate comparisons done with the various AIM subscale, with respect to the effects of REM deprivation.

Furthermore, there were no effects found for any of the scales that were used to rate these reports. This includes the Antrobus et al. subscales and the DF and Primary Visual Experience scales. The Antrobus scales have not been applied in a REM deprivation study and it is unstated in the Cortical Activation model with which they are associated as to the expectations of there sensitivity to REM deprivation conditions.

It should be noted that at the time that this study was first undertaken, the AIM scales had not been utilized in studies other than those reported in the doctoral dissertations of Schwartz (1979) and Weinstein (1981). Therefore, one of the primary methodological objectives of this study was to determine the reliability of these scales as applied to other, similar data sets. This study contributes to this effort in the assessment of reliabilities presented in the Methods chapter. The use of intraclass correlations represents an additional approach to the assessment of reliability of these scales and the results of these analyses demonstrates the ability of these scales to be applied to different data sets.

Apart from the methodological difficulties in the present study, difficulties which may pertain more to the attempt to replicate findings regarding REM deprivation and Nocturnal REM sleep, there could be substantive meaning to the failure to demonstrate an effect of differential sleep stage deprivation on Daytime Sleep Onset mentation. While it has been possible for some researchers to demonstrate the mentation correlates of the ultradian cycle of REM like phenomena, (Kripke & Sonnenshein, 1973) it is possible that the current study sampled daytime reverie mentation in a manner that failed to take into account this type of rhythm. The Multiple Sleep Latency Test schedules nap opportunities at a two hour set of intervals. Had we used electrophysiological criteria to determine the actual presence of phasic events during the day such as PIPs or MEMAs, perhaps there would have been more likelihood of these scale responding to deprivation manipulation. The main point here is that Sleep Onset is a unique and distinctive stage of sleep, which indirectly emphasizes the unique nature of REM sleep as well.

Nevertheless, these data are consistent with findings of Tunney (1992) which were based on nocturnal Sleep Onset reports. In that study, similarly, there were no significant differences seen on any of the AIM scales as a result of differential sleep stage deprivation.

Table 12 - Means and Standard Deviations (in parentheses) of Awakening Condition Collapsed across Deprivation Group.

| Scale<br>(range)    | All Valid Subjects        |                            |                      |
|---------------------|---------------------------|----------------------------|----------------------|
|                     | Pre SO<br>Daytime<br>n=15 | Post SO<br>Daytime<br>n=15 | REM<br>Noct.<br>n=15 |
| Reality<br>(1-7)    | 4.11<br>(0.44)            | 4.05<br>(1.11)             | 4.54<br>(0.77)       |
| Affect<br>(1-7)     | 1.60<br>(0.60)            | 1.60<br>(0.60)             | 1.76<br>(0.54)       |
| GramSelf<br>(0-1)   | 0.35<br>(0.28)            | 0.43<br>(0.20)             | 0.56<br>(0.21)       |
| Temporal<br>(0-1)   | 0.12<br>(0.14)            | 0.11<br>(0.15)             | 0.13<br>(.13)        |
| Global<br>(0-1)     | 0.31<br>(0.25)            | 0.41<br>(0.23)             | 0.58<br>(.21)        |
| Sensory<br>(1-5)    | 2.77<br>(0.72)            | 2.61<br>(0.78)             | 2.61<br>(0.73)       |
| SelfObs.<br>(1-5)   | 2.46<br>(0.62)            | 2.56<br>(0.73)             | 2.56<br>(0.72)       |
| SelfView<br>(0-1)   | 0.033<br>(0.03)           | 0.091<br>(.125)            | 0.042<br>(0.067)     |
| Clear<br>(1-5)      | 2.92<br>(0.61)            | 2.84<br>(0.84)             | 3.19<br>(0.59)       |
| DreamFan<br>(0-7)   | 5.542<br>(1.09)           | 5.83<br>(1.06)             | 5.94<br>(1.23)       |
| TotalCon<br>(0-246) | 28.13<br>(15.44)          | 33.70<br>(17.03)           | 41.58<br>(31.98)     |
| SelfPart<br>(0-7)   | 0.474<br>(0.482)          | 0.509<br>(0.497)           | 0.816<br>(0.547)     |
| Clear<br>(1-5)      | 3.15<br>(0.67)            | 2.80<br>(0.94)             | 2.97<br>(0.77)       |
| Vivid<br>(1-5)      | 3.17<br>(0.70)            | 3.02<br>(0.82)             | 3.11<br>(0.747)      |

Table 13 - Simple effects of the post-hoc comparison of Daytime Sleep Onset vs. Nocturnal REM Mentation (within subjects).

|            | Hypoth<br>MS<br>df=1 | Error<br>MS<br>df=14 | F     | sig of<br>F |
|------------|----------------------|----------------------|-------|-------------|
| Reality    | 2.150                | 0.335                | 6.41  | .024*       |
| Affect     | 0.256                | 0.265                | .967  | .342        |
| Sensory    | 0.068                | 0.422                | .162  | .693        |
| Clear      | 0.000                | 0.767                | 0.00  | .976        |
| Vivid      | 0.001                | 0.811                | 0.001 | .996        |
| SelfObserv | 0.027                | 0.373                | 0.074 | .789        |
| Global     | 0.508                | 0.037                | 13.48 | .003*       |
| GrammSelf  | 0.298                | 0.032                | 9.149 | .009*       |
| Temporal   | 0.002                | 0.009                | 0.297 | .594        |
| SelfView   | 0.004                | 0.006                | 0.687 | .421        |
| TotalCont  | 1138.1               | 495.76               | 2.296 | .152        |
| SelfPart   | 1.056                | 0.089                | 11.81 | .004*       |
| DreamFant  | 0.634                | 0.918                | 0.694 | .420        |

Note: Asterisks indicate significant contrasts with p values at least less than  $p = .05$

### **A Post Hoc analysis of the discriminability of Daytime Sleep Onset from Nocturnal REM sleep**

The planned comparisons in this study were aimed at determining whether deprivation of sleep from different stages would have different effects on REM mentation as opposed to Daytime Sleep Onset mentation. The experimental procedures failed to demonstrate any differences with respect to the most involved manipulation, i.e. the REM deprivation, vs. Stage 2 deprivation. At this point we would like to take up another question that the current data set could feasibly speak to. This is the issue of the discriminability of Daytime Sleep Onset mentation from Nocturnal REM period mentation. As had been reviewed in earlier chapters, this issue has dated back to the inception of modern sleep and dream research (Vogel, Barrowclough & Geisler, 1972) but remains a relevant question in the current literature (Bosinelli, Cavallero & Cicogna, 1982; Foulkes & Schmidt, 1983).

In order to address this question an additional analysis was carried out in which the reports from the Daytime Sleep Onset conditions were contrasted with the nocturnal REM period reports. Referring to Table 12, a comparison was made for each of the 13 scales based on a mean of cells in columns one and two with the cells of column three. The SPSS REPEATED MEASURES subprogram of MANOVA permits such a contrast which is termed a "difference

contrast" In this procedure, the first two levels of the variable are contrasted with the following level. The contrasts were made after collapsing the "groups" i.e. without respect to the type of deprivation (REM vs Stage 2-NREM). Collapsing the groups in this way would seem to be logical given that there were no meaningful differences found in the orthogonal contrasts presented in Table 6 between REM deprived and stage 2 deprived conditions - or between Pre- and Post-deprivation conditions in the Daytime Sleep Onset reports (Table 10 and Table 11).

As can be seen in Table 13, four of the scales showed significant differences between Daytime Sleep Onset and Nocturnal REM mentation. The Reality Scale showed significant increase in value of Nocturnal REM over Daytime Sleep Onset, ( $F = 6.41$ ,  $df = 1$  and  $15$ ,  $p = .024$ ). The Global Scale showed a significant increase of Nocturnal REM over Daytime Sleep Onset ( $F = 13.48$ ,  $df=1,15$   $p=.003$ ). The Grammatical Self Reflections Scale showed an increase of Nocturnal REM over Daytime Sleep Onset ( $F = 9.149$ ,  $df 1$  and  $15$ ,  $p = .009$ ). Finally, the Self Participation scale showed a significant increase of Nocturnal REM reports over Daytime Sleep Onset reports ( $F = 11.81$ ,  $df = 1$  and  $15$ ,  $p = .004$ ).

To summarize, the Reality, Global and Grammatical Self-Representation subscales of the AIM Scale and the Self-Participation scale of the Psycholinguistic Scoring Manual demonstrated significantly greater values for the Nocturnal

REM reports than for the Daytime Sleep Onset mentation reports. While these findings are subject to the same methodological limitations as the planned comparisons already discussed, they do suggest that there is a tendency for the REM reports to be judged as demonstrating more Absorption in Mentation, and that there is less of a tendency to represent the self in the verbal reports of Daytime Sleep Onset than the dreams of REM sleep. These findings are interesting in light of the failure of the DF scale to reflect a difference in "dreamlikeness" (hallucinatory quality, bizarreness or perceptual quality) between the Daytime Sleep Onset reports and Nocturnal REM reports. In addition, the Total Content Count from the Antrobus (1983) Psycholinguistic Manual also failed to reflect significantly longer or greater content-filled reports from the Nocturnal REM period.

These findings suggest that REM mentation is discriminable from Daytime Sleep Onset mentation on dimensions which have heretofore been shown to be sensitive to the presence of phasic events. This is consistent with the view that REM mentation is qualitatively different from the type of hallucinatory mentation found during the change of consciousness that accompanies sleep onset. The findings also suggest that this difference is associated with the way that the self is experienced or represented. The GSR subscale and the Self-Participation subscale are similar in

that they index the presence of the persona of the dreamer as grammatically represented in the narrative of the dream. To some extent, the fewer instances of such representations in the Daytime Sleep Onset reports than REM reports is consistent with the findings of Foulkes & Schmidt (1983) who found a greater presence of self-characters in REM mentation as compared to Nocturnal Sleep Onset reports. In recent studies differences in mentation associated with differences in sleep stage have been attributed primarily to quantity of mentation, whether measured in "thematic units" (Foulkes & Schmidt, 1983) or Total Content Count (Antrobus, 1983). The current findings of differences based on qualitative aspects of self-experience are supportive of Bosinelli's (1991) contention in reviewing recent sleep onset mentation literature that while "differences between Sleep Onset mentation and mental activities of other stages (especially REM) are frequently interpreted in quantitative terms, ...residual qualitative differences can also be observed, and they are not easily attributable to pure quantitative factors." (p.141) However, the statistical methods applied in the present study are somewhat different than those of Antrobus (1983) and Foulkes & Schmidt (1983); they both employed the dream reports as the unit of analysis, while the present study included the subject's means for the various conditions compared as the unit of analysis.

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