REM DEPRIVATION: The effects on ink blot perception and fantasy processes

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TABLE OF CONTENTS

CHAPTER PAGE

CHAPTER I

A. STATEMENT OF THE PROBLEM

Sleep is as universal a phenomenon (or perhaps group of phenomena) as any other biological function of animals. We are drawn into the waiting and irresistible arms of Morpheus and then released by her in a fairly consistent cyclic pattern. We feel instinctively that sleep will help us when we are ill and know practically that we will suffer from discomfort and loss of efficiency in our daily tasks if we break the cyclic pattern of sleep and wakefulness. And yet, little is known scientifically about the relationship of the processes of sleep to the processes of our waking life. Sleep research has increased dramatically in the past decade, but the main thrust of the studies has related to the intra-sleep process and, particularly, the establishment of a body of normative data. In 1960, a pioneering study by Dement held out the promise of understanding of a relationship that appeared to exist between a particular kind of sleep and a person's waking psychophysiological adjustment. The particular kind of sleep in question is determined by electroencephalographic activity of a clearly distinguishable nature and is alternatively labelled as ascending Stage I or as REM (rapid eye movement) sleep.

Dement's study was entitled <u>The Effects of Dream Deprivation</u>. It was apparently his assumption, at the time,

that by depriving subjects of REM sleep, he would also deprive them of a chance to dream and that whatever consequences were to accrue from this procedure would be the result of the loss of the dream. By this time, a fairly solid connection had been discovered between this stage of sleep and dreaming. It is not surprising that all of the lore about dreams, both ancient and modern, would subtly influence the experimenter and his readers, many surely making the assumption that Freud's "royal road to the unconscious" was simply an archaeological expedition or two ahead. Dement noted that the more a subject was REM deprived, the more difficult it was to keep him from entering this stage of sleep, and that once an individual was relased from this depriving regimen, he would spend more time than usual for him in "making up" this missed stage of sleep. As a result, such phrases as "the need to dream," "REM pressure," and "REM rebound" began to appear in the literature. Dement also noted that his subjects seemed to suffer some untoward psychological effects as a result of their experience. This heightened the feeling that a basic psychological truth about dreaming was within grasp.

Ten years later, the rebound effect is a well established phenomenon, but relatively little data has been gathered to support Dement's original observation of psychological deficits occurring as a result of REM sleep deprivation. On the whole, most experimentation, in which

psychological measurements were systematically made following REM sleep deprivation, showed no significant differences as a result of the deprivation. A review of the literature on REM deprivation (Vogel, 1968) leads this author to the conclusion: "A review of all known published REM deprivation studies on humans indicates that the procedure was probably innocuous for all subjects except two." (p319) He (Vogel) further speculates that for these two subjects, who were deprived of REM sleep for 15 and 16 nights respectively, the observed psychological consequences were the result of uncontrolled variables rather than directly due to REM sleep deprivation. Nevertheless, some evidence has accumulated which does show apparent effects on waking responses of subjects dependent upon the vicissitudes of their prior REM sleep. One such study was that of Lerner (1966), who investigated the change in movement responses on a projective ink blot test following drug induced REM sleep reduction. Clemes and Dement (1967) showed both a change in movement responses as well as an increase in pathological verbalization on an ink blot task following laboratory controlled REM deprivation. The results of these studies were neither congruent as to the direction of the resulting changes, nor were they essentially comparable in their methodology. Accordingly, the present study was designed to bring some clarity to the disparate results obtained by these latter two authors and to help shed light on the lar-

ger problem that of understanding what, if any, relationship exists between waking psychological function and REM sleep.

B. BACKGROUND

A serendipitous discovery by Aserinsky and Kleitman (1953), that subjects awakened after a period of sleep characterized by the occurrence of rapid conjugate eye movements were likely to report a dream, led to an almost immediate proliferation of sleep and dream research. Undoubtedly, the excitement that was stirred related to the expectation that a new methodology had arisen for studying the elusive mental phenomenon of dreaming. As far back as 1896, Ladd had speculated on the relationship of eye movements to dreaming, and this was brought to our attention again by Jacobson in 1930. However, it was not until the '30's that electroencephalography became available as a clinical tool. Taken in historical perspective, considering that a World Was intervened and that modern electronics has been largely a post war development, it is not at all surprising that sleep and dream research had to wait for the middle '50's to begin in earnest.

When Aserinsky, working in Kleitman's laboratory, decided to use electroencephalographic recordings of eye movements rather than to directly observe eye movements of their sleeping subjects, he was applying an available tool in such a manner as to create the possibility of discovery.

They found that sleeping subjects regularly passed through a period of sleep in which rapid, binocularly symmetrical eye movements occurred along with changes in other physiological parameters such as heart rate and respiration rate. At this same time, brain activity, as measured electronically, showed a fast, low voltage desynchronized wave that corresponds in many ways with that observed in waking subjects. They postulated that these conditions were concomitant with dreaming and proceeded to find positive evidence in favor of their hypothesis by waking their subjects during these rapid eye movement (REM) periods and collecting their verbal reports. They found that dreams could be expected 74% of the time from these awakenings, but only 7% of the time when awakenings were made during other periods of sleep. This latter type of sleep (NREM or non-REM) is electronically characterized by much larger and slower synchronized waves, and is devoid of the conjugate eye movement bursts.

Following publication of the work of Aserinsky and Kleitman and follow up studies by Dement and Kleitman (1957a), it became clear that the period of sleep in which rapid conjugate eye movements (REMS) occurred was a unique physiological state of the organism. Because of the evidence associating this stage of sleep with dreaming, it also became to be viewed as a unique psychological state, and many began to talk of the psycho-physiological uniqueness of REM sleep. Dement and Kleitman (1957b) tested the

hypothesis that dreaming was exclusively a function of REM sleep. They found that they could elicit dreams from their subjects approximately ten times more often when awakening them from REM sleep than when awakening them from other sleep stages. These findings have been replicated many times with results always in the same direction (if not of the same magnitude) as the original studies. Snyder (1967) lists nineteen studies completed over the period 1953 to 1965, all of which show that the greatest amount of dream recall is obtained from REM sleep. Besides the mere number of reports following awakenings from REM and non-REM sleep, qualitative differences were also discovered. Monroe, Rechtschaffen, Foulkes, and Jensen (1965), in their discussion of earlier studies, point out:

> "REM content was also judged by the experimenter and/or the subject to be more vivid and clear, to involve greater activity, to include more visual imagery, to refer less often to recent events in the dreamer's life, to be more emotional and to be more distorted and implausible than NREM content." (p 465)

The Monroe, et al. study showed that REM reports were highly discriminable from non-REM (NREM) reports even when a variety of controls were imposed upon the judges. However, a sufficient amount of dream recall occurs in NREM states to call into question conclusions by some (Fisher, 1965; Lerner, 1966) that the REM state and dreaming are inextricably and uniquely intertwined. Thus, Foulkes (1962), defining dreams in terms of the occurrence of "sensory

imagery" or "altered identity or physical setting," reported the occurrence of dream reports in 54% of NREM awakenings.

Howsoever one interprets the evidence pertaining to REM sleep, its uniqueness as a qualitatively different moment in the life of the individual cannot be denied. The electroencephalographic pattern alone, without recognition of other physiological measures and without speculation as to whether the dream is uniquely a concomitant of this stage of sleep, would be sufficient to justify a search for the functional aspects of this condition in the economics of the individual. The REM state has been studied both ontogenetically and phylogenetically with the subsequent recognition of its universality. New born infants show a REM pattern which differs very little from that of adults except in amount of time spent in this state (Roffwarg, Dement, and Fisher, 1964). New borns spend half of their sleeping time in REM. The adult human spends approximately 20% of his sleeping time in REM. All other mammals that have been studied show REM periods of varying duration and quantity, but with similar physiological characteristics to those of man. Snyder (1965) identifies studies of the dog, cat, monkey, rabbit, sheep, goat, chimpanzee, mouse, and even the phylogenetically oldest mammal, the oppossum. Neurophysiological evidence places the mechanism of REM in the most primitive portion of the brain, the pons. This again suggests that understanding the phenomenology of the REM

state may well lead to many basic discoveries about mammalian life.

It would be hard to conceive of a recurrent pattern of unconscious physiological events such as the REM period that did not serve functionally for the organism. Early investigators (Dement, 1960; Fisher and Dement, 1963; Sampson, 1965; Kales, Hoedemaker, Jacobson, and Lichtenstein, 1964; Lerner, 1966) made the implicit or explicit assumption that REM time was dreaming time and that whatever function was served by this REM state inhered in the dream. That this assumption may be challenged and has been from many quarters, for instance, Kubie (1962), Snyder (1965), does not detract from a methodological approach first developed by Dement (1960) and called "Dream Deprivation." Dement recognized that functional significance might best be recognized through absence. He apparently felt that depriving a subject of REM sleep might highlight its function by the effects upon the deprived subjects. The technique was to simply awaken the subject each time the electroencephalographic pattern heralded the arrival of a REM state. After a depriving regimen of several days, the subject was usually allowed to sleep undisturbed during "recovery" nights while electrophysiological monitoring continued.

Dement's now classical technique demonstrated even more clearly the uniqueness of the REM state, but did not, as he just assumed, show that dreaming was an essential

need. He found that as experimental nights continued, it became more and more difficult to keep the subject from going into REM, and that on post-experimental nights (recovery periods), they showed a distinct increase over baseline nights in the amount of time spent in REM. This finding of "REM pressure" or a "need for REM" was quickly interpreted as a "need to dream." That there appeared to be a "REM pressure" phenomenon was confirmed by others (Rechtschaffen and Maron, 1964; Kales, et al., 1964; Sampson, 1965) and is now perhaps one of the most widely accepted phenomenon of sleep and dream research. That dreaming was the essential characteristic of REM rather than merely an epiphenomenon of a more basic biological need is much more difficult to demonstrate, and indeed, theoretical discussions tend to divide sharply around this point.

Using psychoanalytic underpinings, Fisher (1965) became an eloquent spokesman for the position that "REM pressure" was "dream pressure" and that discharge of instinctual drive tensions was served by the REM dream process. Fisher does not argue that the physiological aspects of REM are not ontogenetically prior to dreaming, but rather that during early infancy, soon after memory traces are laid down and satisfaction and frustration have been experienced, a new process comes into being, "namely, the regulation of instinctual drive discharge processes through hallucinatory wish fulfillment, as opposed to

physiological discharge through motor patterns" (p 280). Using the evidence that had been gathered up to the time of publication (Dement, 1960), he felt that serious psychological consequences could result from the loss of REM sleep. He leaves no doubt that he is convinced that these consequences would be the result of the curtailment of the psychic dream mentation. His view is that psychotic symptomatology can be equated with the breakthrough of the dreaming process into the waking ego.

Other theoretical positions accord the dream a far less significant role. For instance, Snyder (1967) reviews theoretical positions taken by others:

> "Roffwarg, et al. (1966) have proposed that REM has a primarily developmental function, serving to assist the processes of central nervous system differentiation and maturation by providing massive endogenous stimulation prior to the availability of sensory experience. Ephron and Carrington (1965) have suggested a homeostatic hypothesis, that the regular recurrence of REMS maintains optimal levels of cortical functioning during sleep. I have speculated that the organismic arsenal of REMS has a 'sentinel' function, providing periodic preparedness and surveillance of the environment for external dangers with minimal interruption to the continuity of sleep (Snyder, 1966)." (p 75)

In addition, Dement (1964, quoted from Fiss, Ellman, and Klein, 1969) has proposed that the REM state serves to clear the central nervous system of certain metabolic substances which in themselves could be toxic. Berger (1968, quoted

from Fiss, et al. 1969) presumes that the function of REM is simply to innervate the oculomotor system.

While much experimental investigation of the REM state has been physiological in nature, the primary tool for evaluating possible psychological function of REM in humans is the REM deprivation technique first employed by Dement (1960). While some have employed drugs to effect REM deprivation (Lerner, 1966), it is always a question mark in the results, as even careful controls are unlikely to dispel all doubt that the drugs are not implicated in the final result. Dement's original deprivation study led to certain behavioral observations of the REM deprived subjects which appeared to indicate that adverse psychological effects resulted from his procedure. He noted increased anxiety, memory disturbances, motor incoordination, and increased irritability. Follow up studies by Fisher and Dement, and Dement and Fisher are reviewed and evaluated by Fisher (1965). He reports increased orality of an uncontrollable quality, increases in primary-process thinking as measured by Holt's primary process Rorschach and development of hallucinations as a consequence of photic stimulation. Of a subject deprived systematically for sixteen days by a combined method of forced awakenings and drug administration, Fisher notes that the subject showed a drastic change in personality, including paranoid ideation and production of autistic material. However, he also reports that on the day after the first recov-

ery night, during which REM time was increased approximately three-fold, the subject became his normal self.

Vogel (1968), in a review of REM deprivation studies, finds only one additional study to support the early observations of Dement and the conclusions drawn by Fisher from his work with Dement. The study is by Sampson (1966) who REM deprived six subjects for a total of three consecutive nights and reported similar findings to those of Dement. In contrast to these reports, other investigators did not find psychological deficits resulting from REM deprivation. Kales, et al. (1964) attempted to assess both quantitative and qualitative effects of deprivation through both observation and psychometric testing. In both instances, they could find only minimal psychic changes, and these, they said, were as characteristic of the controls as of the experimental subjects. In addition, both Snyder (1963) and Foulkes, et al.(1967, as quoted in Vogel) could not find similar effects to those psychological deficits first reported. Feinberg, et al. (1964, quoted by Vogel, 1968) found that actively ill schizophrenics, as well as four schizophrenics in remission, did not show REM percentages on total amounts of REM that differed significantly from controls. Vogel and Traub (1968) deprived schizophrenic subjects for seven nights without detecting intensification of symptomatology or significant psychological changes as measured by reli-

able tests. At this point, it would seem that the REM phenomenon, which clearly has a consistent presence and an insistent demand on our sleeping time and which is associated with dream production, may yet not be implicated in our psychic stability as Fisher (1965) has indicated. This, of course, does not in any way reject the idea that dreams may be revelatory of psychic structure and dynamics.

One of the most consistent findings of REM deprivation studies, aside from the consistent physiological parameters, is the REM compensation that both animals and humans exhibit after REM deprivation. The number of studies which demonstrate this effect is such as to leave little doubt that a basic mechanism is involved. There appears to be a rough quantitative effect. Thus, Dement, Greenberg, and Klein (1966) delayed the post-REM deprivation recovery nights after a five night depriving regimen by only allowing base-line amounts of REM time on the subsequent five nights of sleep. Following this, they allowed the subjects uninterrupted sleep and found that the REM-compensation was essentially the same as if the recovery nights immediately followed the deprivation nights. It appears that the REM deficit accumulated and waited for the earliest opportunity to be "discharged." It is, therefore, of extraordinary interest that Zarcone, Gulevich, Pivik, and Dement (1968) and Zarcone, Gulevich, Pivik, Azumi, and Dement (1969) have reported that schizo-

phrenics, that are acutely psychotic with active symptomatology, do not show REM-compensation on recovery nights, while schizophrenics in remission show an increase in REM-compensation, which is excessive when compared with normal subjects. Vogel (1968) reported that of five depressed patients, that he REM deprived over periods of seven to fourteen nights, two did not show compensation phenomena, while two others, that showed a consistent increase in REM pressure and compensatory REM on recovery nights, also showed rapid recovery during this "treatment." The clinical recovery of these patients was mirrored by concurrent psychological testing. These findings open up over again the question of the relationship of the REM state to psychological functioning.

Several approaches to shedding light on the phenomenon and its interrelated characteristics immediately present themselves. One approach is to attempt to manipulate external variables and examine the resulting effects on subsequent or concomitant REM states. Thus, Cartwright and Monroe (1968) tested the hypothesis that compensatory REM sleep depends on the kind of activity that is substituted for the missed REM. They REM-deprived subjects under two conditions: one in which the subjects were allowed to report the contents of their pre-awakening mentation, while in the second condition, the subject's attention was preempted by an externally imposed digit repetition task.

Those subjects who had the chance to verbalize their spontaneously developed mentation did not show REM compensation when allowed to sleep uninterruptedly, while the digit repetition subjects showed the normally expected compensation phenomenon. A second approach is to follow the classical deprivation technique and apply different and perhaps finer psychological instruments to the deprived subjects in order to determine if psychological balance is disturbed or changed even if sufficient ego controls remain to prevent spill-over into behavior. This is the approach of several researchers (Lerner, 1966; Clemes and Dement, 1967; Greenberg, Perlman, Finzar, Kantrowitz, and Kawaliche, 1970).

Lerner (1966), taking account of a similarity between the kinesthetic experiences in dreams and movement responses on ink blot projective tests as first suggested by Rorschach, predicted that REM deprived subjects would show increased movement responses on an ink blot test. She also predicted a qualitative deterioration of the movement response in the direction of imagery depicting body dissolution or loss of ego boundaries. Her thesis was that the kinesthetic experience in dreams reinforces body image and that ego integrity is dependent on body image. This study was carried out with subjects that were presumed REM deprived by the administration of drugs (d-amphetamine sulphate + pentobarbital sodium) known to

reduce REM time. Lerner's results confirmed her hypotheses. Clemes and Dement (1967), using the forced awakening technique, applied the same psychological instrument, the Holtzman ink blots, to the deprived subjects and found results opposite to those of Lerner with regard to the movement responses, but found that REM deprived subjects were prone to producing significantly more pathognomic verbalziation, a category which should subsume Lerner's body dissolution imagery. Greenberg, et al. (1970) REM-deprived four subjects and again explored their psychological condition by means of an ink blot test. He finds no difference in the ordinary scoring categories, but evaluation of the Holtzman protocols showed that typical defensive structure of each subject did not prevent him from revealing material that he normally defended against. Thus, a subject that showed activity and hypomanic defenses showed depression on the projective protocol when he was REM-deprived. Each of these researches indicates that there is much to learn about the REM state through a combination of the classical deprivation technique and the application of sensitive psychological measures.

C. IMPLICATIONS OF THE ABOVE DISCUSSION FOR THE PRESENT STUDY

From the above discussion, we may suspicion that the REM state, which is a universal phenomenon of mammalian life, is also implicated in human psychology. The

questions that arise are, of course, manifold in this connection. Fisher has suggested that the quantity of REM may be important as a regulating mechanism of instinctual impulses. Others (Shapiro, 1966; Greenberg, et al. ,1970) have suggested cognitive models in which REM sleep is seen as a period in which some kind of data processing takes place either putting data into permanent storage banks or in some way incorporating and resolving the day residues that have aroused uncomfortable wishes and unresolved conflicts. Other models (Dement, 1966 and Berger, 1968, quoted from Fiss and Ellman and Klein, 1969) stress the biological aspects, such as the removal of toxins or maintaining a physiological homeostasis.

At the moment, the dream deprivation technique appears to be the best method of reaching and understanding of the functional aspects of REM, although other techniques, such as varying psychological conditions and observing the effects on the REM period as Cartwright and Monroe (1968) have shown, may also lead to insights. Some attempt to use psychometric tests and cognitive tasks following deprivation have not shown performance decrements. However, this does not rule out the possibility that REM does serve a psychological function, but may only serve to attest to the adaptability of the organism. The use of projective tests, on the other hand, lays open the possibility of detecting more subtle psychological influences in the

"normal" subject.

In the work already done using projective indicators, some confusing results have been seen. Using movement as a major determinant, on an ink blot task, Lerner (1966) demonstrates a significant increase in movement responses quantitatively and a significant qualitative change as well. On the other hand, Clemes and Dement (1967), using an ink blot projective test, find a significant decrease in movement responses, but also show a qualitative deterioration of the subjects verbalizations. Greenberg, et al. (1970) finds no significant change in scoring determinants on an ink blot test, but shows that anxiety material, normally defended against by a subject, is more easily expressed on a post-deprivation protocol. Of these studies, only Lerner has used a sufficiently large sample, but her work is contaminated by the REM depriving procedure which was accomplished through the use of drugs alone and with the S sleeping at home. Both Clemes and Dement and Greenberg, et al. have used the method of forced awakenings, but have employed only six and four subjects respectively. Thus, it seems that a controlled study, using projective test evaluation; an adequate N; and the forced awakening technique, is a necessary step at this time to evaluate the possibility of subtle psychological influences occurring as a result of REM deprivation.

D. OUTLINE OF THE PRESENT STUDY AND DEVELOPMENT OF HYPOTHESES

Independent Variables

1. Subject Variables

The purpose of this study was by and large related to the broad question of the relationship of the REM state and its vicissitudes, to the waking functioning of its subjects. However, the possibility of examining the potential differential functioning of subjects who could be securely divided along psychological attributes held the possibility of broadening and deepening the results once obtained. To this end, two subject variables were chosen. These were considered because they were easily obtained without adding an undue burden to subjects who were already heavily taxed by the experimental procedures. These were Field Dependence as measured by a miniature rod and frame apparatus and a questionaire in which subjects rated themselves according to their imaginative predisposition.

a. Field Dependence - Independence (FD - FI)

Field Dependence was first studied with regard to an individual's recognition of his body orientation in space (Witkin, 1949) and was later shown to be a concomitant of personality characteristics (Witkin, et al. 1954). Although the original apparatus for measuring field dependence was complex, a simple device consisting of a luminescent rod and a frame was able to differentiate sub-

jects along this dimension. The subject is tested in a dark room. His task is to align the rod with his body axis, i.e., vertical. When the frame, which is the only visible reference, is tilted, the subject is confronted with two apparent vertical reference points, the external frame axis and the internal perception of his vertical body axis. The final positioning of the rod is usually a compromise between these referents. The compromise of the field dependent individual is more toward alignment with the frame axis, while the compromise of the more field independent is toward alignment with his body axis.

The psychological ramifications of the processes which account for the kind of compromise that emerges in the rod and frame test were consistent enough for Witkin to talk about a cognitive style, a reasonably consistent pattern of cognitive attitudes with which a person confronts the world. The work of Witkin and others (Eliot, 1961) indicates that the field independent subjects, as opposed to field dependent subjects, were more in touch with inner life, more cognizant of their internal body cues, and more able to make use of them. Cartwright (1966) found that subjects, whose cognitive style was more field independent as determined by a grouping of scores on tests which correlate with this attribute, were "better" dreamers than field dependent subjects. "Better" dreamers is understood as subjects producing dreams with more imaginativeness, as

measured on a scale from reality bound to imaginative. These same subjects showed a baseline REM percent, which was higher than that produced by field dependent subjects. A further study (Cartwright, Monroe, and Palmer, 1967) showed that field independent good dreamers could better tolerate REM deprivation in that they showed fewer indications of disruption of EEG and behavioral patterns, but responded with a higher REM percentage on recovery nights following REM deprivation. Cartwright's contention is that field independent subjects are better able to tolerate the stress of REM deprivation and are able to wait for the next available REM state in order to "compensate" for lost REM time. The more field dependent are likely to use other periods of consciousness alteration to "compensate" for REM deprivation.

Cartwright's thesis is that dreaming is the psychological aspect of REM sleep, which is involved in the REM compensation phenomenon. Her work (Cartwright, 1966) and follow up work (Cartwright, Monroe, and Palmer, 1967; and Cartwright and Monroe, 1968) indicate that where the psychological aspects, i.e., dream-like mentation, can be supplied to subjects through some other channel, either through the use of hallucinogenic drugs or by special opportunities to relate dream experience. The amount of compensation of REM time is significantly reduced. Her finding is also that the field independent subject is less amenable

to alternate channel diversion, that he insists on his usual mode of dreaming.

It appears that field independence makes a difference in how subjects respond to REM deprivation. It is, therefore, a reasonable variable to study in a research involving the deprivation of REM sleep. In the present study, the specific concerns are the dependent variables of movement and pathognomic verbalization. Based on the work of Cartwright and her co-workers, the field independent subjects should be less affected by the REM deprivation procedures and should thus show less change in the dependent variables than field dependent subjects.

b. Day-night Dream Frequency (I)

In this study, imaginative pre-disposition is a quantitative estimate of the relative amount of time in which subjects tend to engage in imaginative activities in their daily lives. The instrument for developing the estimate is the Singer-Antrobus (1966), Imaginal Processes Inventory. Part II of the inventory asks the subject to rate himself on 24 items with respect to the frequency that applies to himself. Each item investigates some aspect of the individual's relation to daydreaming, night dreams, or recall of these fantasy events. Thus, the subject is asked to estimate how much daydreaming, how much night dreaming, etc., on a five point scale, and a quantitative estimate of the individual's characteristic use of these

fantasy processes can be obtained by summing the various ratings on the 24 items.

Fiss, Klein, and Bokert (1966) showed that interrupting REM periods produced subject reports that were significantly more dream-like than non-REM interruptions in terms of visual content, affect, and bizarreness. They also found that stories produced, following interrupted REM periods, were significantly longer than stories produced following interrupted non-REM periods of sleep. It seems then that during REM some excitatory process must be in evidence which leads to the production of fantasy in an immediate subsequent period. In this study, the implication is clear that the waking fantasy could be substituting for a sleep fantasy, i.e., dreaming. The questions that arise are (1) whether a person who engages in a great deal of day and night fantasy in his everyday life might be affected differently than an individual that experiences relatively less fantasy in daily pursuits and (2) whether an individual for whom normal REM time is reduced might not show an increased production of waking fantasy over an extended period? Both questions deal with the possible comparability of REM mentation with other fantasy processes and whether or not the presence or absence of one leads to changes in the other.

It might be quite useful in a study of this kind if the quality of an individual's imaginative activity was taken into account. This could be done through a pre-test

using T.A.T. material and evaluating according to a scheme, such as the transcendance index of Weisskopf (1950). Whereas this would unquestionably be valuable, it is not feasible in a study in which the subjects are already heavily taxed. Thus, there was no attempt to go beyond a simple subjective estimate by the subject. Following the hypothesis that comparability exists between different fantasy modes, a first order hypothesis would assume that the higher the individual's estimate of spontaneous fantasy the less noticed would be an interruption in REM fantasy. Thus, it is postulated that effects of REM deprivation on the major dependent variables would be less for high imaginative (HI) subjects. The subjects were thus divided into "HI" and "LI" groups according to their relative standing on a ranking of their summed scores on the 24 items.

2. Treatment Variables

The subjects slept in the laboratory for two periods, each consisting of three nights. During the first of these periods, the subjects were interrupted during each and every REM period in order to significantly reduce REM time. Although each subject varied in the number of attempted REM periods so that awakenings were not uniform, in the second three night period, which acted as a control condition, the same number of awakenings as was originally required for reducing REM time was effected at periods

other than REM. This is, therefore, a design in which each subject is his own control. The independent variable is thus defined by the state of the subject at the time of measuring the dependent variables. These states are REM-deprived or non-REM deprived. The study in essence asks the question whether or not these states are discriminable through the measures of the dependent variables.

Dependent Variables

The study was designed to demonstrate the effects of the treatment and subject variables through the use of (a) a projective test, the Holtzman Inkblots and (b) through a special laboratory set up designed to elicit a quantitative estimate of the extent to which a subject experiences spontaneous fantasy unrelated to the task in which he is engaged. This task irrelevant fantasy is designated as TIF.

1. Movement

Lerner (1966), following a suggestion of Herman Rorschach, found that REM deprived subjects produced significantly more movement responses on an ink blot test following drug induced REM deprivation. Rorschach had apparently called attention to the similarity of movement responses to dreams noting that in each case there was kinesthetic experiences without overt movement. Monely Vould had concluded from his work in 1910-12 that motor

inhibition facilitated subsequent night dreams with expansive movements (cited from Piotrowski, 1957). Similarly, more recent works (Singer, Meltzoff, and Goldman, 1952), (Meltzoff, Singer, and Korchin, 1953) have established that overt motor inhibition leads to an increased production of movement responses on a Rorschach task. Rorschach workers, in general, related movement responses and particularly the human movement response to the capacity for inner living. The projection of movement into static ink blots is taken as a sign of the individual's capacity to restrict motility and overt action in favor of an internal working through of a life problem through creative fantasy. Piotrowski (1957) speaks of M (human movement) types as individuals who contain their complexity within themselves, who can ward off the stimulations of the environment and make judgements according to their internalized scale of values. Beginning with Rorschach, himself, and continuing almost universally through Rorschach literature, is the idea that movement represents intrapsychic imaginary activity as opposed to an extroverted orientation toward outside stimulation. It is, therefore, a desirable choice of variable to compare with the vicissitude of the REM state. REM mentation, which appears from much evidence to harbor the fantasy we call dreams, is almost the epitome of a wholly intrapsychic process having reduced sensory input to an absolute minimum. Whether a common substratum exists and can be observed by

depriving in one area and observing changes in the other is an obviously important psychological question.

This study seeks to replicate the work of Lerner (1966) by demonstrating a quantitative change in the production of movement responses as a result of curtailing REM time. Clemes and Dement (1967), it should be noted, obtained a significant decrease in movement responses following REM deprivation. While this result is contradictory, it makes the need for replication even more imperative since the departure from the null hypothesis is significant in both researches, albeit in opposite direction.

2. Pathognomic Verbalization

Among the earliest REM deprivation studies, Dement (1960), Fisher and Dement (1963), and Sampson (1966) were indications that subjects, deprived of REM sleep, displayed behavioral changes in the direction of greater psychological disturbance. Fisher (1965) summarized the disturbances of REM deprived subjects in the following terms:

> "(1) moderate degrees of tension and anxiety with a major anxiety attack in one subject; (2) brief period of depersonalization in one subject; (3) disturbances in motor coordination, e.g., dropping of small objects; (4) memory disturbances, e.g., forgetting appointments; (5) difficulty in concentration; (6) increased startle reaction in one subject; (7) development of irritability and hostility; (8) disturbances in time sense in social subjects." (p 242)

He also called attention to the development of bulimia in

four subjects and a significant increase in primary process thinking as measured by Holts method of measuring primary process through the Rorschach.

Fisher (1965) interprets the REM deprivation phenomena through psychoanalytic insights and feels that REM is associated with the discharge of instinctual drives. He considers the symptomatology of REM and sleep deprivation to be due to "the breaking through of the dreaming process into the waking ego." (Fisher, 1965, p 281.) However, Kales et al. (1964) and Sampson (1966) found no differences in the results of psychological testing of their REM deprived subjects, and Vogel (1968), in an extensive review of the REM deprivation literature, pointed out that all of the evidence which linked REM deprivation with eruption of psychopathology was based on observation unsupported by reliable psychological indications. He concludes that REM deprivation has not been demonstrated to be harmful to man. In fact, some evidence has accumulated that links psychopathology to REM, although it would not be sufficient to support Fisher's hypothesis. Zarcone, et al. (1968) showed that schizophrenics in remission are peculiarly sensitive to REM deprivation, compensating with increased REM sleep far above their baseline values. At the same time, schizophrenics, in an active psychotic state, are peculiarly insensitive to REM deprivation and compensate very little if at all. This finding is compatible with hypothesis of sub-

stitutability of overt waking psychotic manifestation and REM phenomena. Vogel (1968) does not include the work of Lerner (1966) and Clemes and Dement (1967) in his review. Both studies evaluated Rorschach responses in terms of loss of ego controlled rational processes. Lerner focused on body dissolution imagery in lines with her theory of dreams; that is, kinesthetic dream experience confirms body boundaries, while Clemes and Dement used pathognomic verbalization, a category clearly and comprehensively worked out for the Holtzman ink blot scoring system. In each of these instances, there were significant differences between the REM-deprived and the non-REM deprived state. Greenberg, et al. (1970) found no difference in the pre- and post-REM deprivation cognitive tests, but showed that on projective tests there were significant differences in the quality of the material presented. Specifically, anxiety areas, previously defended against, were openly expressed in the REM deprived state.

The evaluation of the ink blot records of this experiment in terms of movement toward pathology thus seems like an obvious advantage in helping to clarify the effects of REM deprivation. Holtzman's scoring technique for pathognomic verbalization was chosen for several reasons. It is clearly defined by Holtzman, et al. (1961) having been given prime importance in the development of the test. The authors state, "more effort was expended in developing

an explicit rationale and scoring system for pathognomic verbalization than for any other variable in the Holtzman inkblot technique." (p 52). Of the scorable responses indicating the presence of deteriorated quality that were given by Lerner (1966) in her examples, all would be scored by the Holtzman Pathognomic Verbalization criteria. Direct comparability of this study could be made with that of Clemes and Dement (1967), and future work of a similar nature would have a sound basis of comparison. Pathognomic verbalization is essentially a measure of autistic thinking as differentiated from secondary process logical thought. It is based on a scheme in which the psychological distance of the subject from the perceptual stimuli is evaluated. Extremes in either direction, that is, taking the stimulus as more or less real would be a pathognomic response that is too close, while completely ignoring the material and the test conditions, while still giving specific responses, is psychologically the equivalent of being too distant. Either situation indicates the presence of autistic process or, conversely, the loss of reality testing to the extent of the deviant nature of the response. Evaluation of the shift of pathognomic verbalization from non-REM deprived to REM deprived can be an indication of whether or not disruptive psychological effects may result from the loss of REM sleep.

3. Task Irrelevant Fantasy

This dependent variable concerns itself with the

quantitative evaluation of fantasy production under each state of the independent variable. Fiss et al. (1966) have shown that there is carry-over from the mentation of REM to waking fantasy, and Fiss et al. (1969) have shown that interrupted REM periods lead to behavior that may be interpreted as an attempt to resolve or complete the psychic activity begun in the REM state. Cartwright (1966) showed that prior hallucinogenic experience diminishes subsequent REM time. One is thus led to ask whether reduced REM time leads to an increase in subsequent waking fantasy process on a quantitative level. If this were so, it would be an indication of firstly, a connection between daydream and night dream and secondly, that what happens in REM affects our waking behavior. Antrobus, Singer, and Greenberg (1966) have described a methodology for determining the quantity of intrusive fantasy that a person experiences while performing a cognitive task. The subject is given a clear cognitive task to engage his attention while extraneous stimuli are excluded from the environment. Under this circumstance, it is possible to interrupt the task at preset intervals and query the S as to whether thoughts have occurred to him unrelated to the task at hand. Thus, a simple quantitative measure can be obtained of the extent to which fantasy processes force themselves onto the individual

E. STATEMENT OF HYPOTHESES

Based on the foregoing discussion, the following

hypotheses were developed and explored in this study:

1. Movement

   Deprivation of REM sleep will result in increased movement responses on a subsequent Rorschach task.

2. Pathognomic Verbalization

   REM deprivation will increase pathognomic verbalization as measured by a subsequent Rorschach task.

3. The Effect of a Cognitive Style

   Field independent Ss will be less affected by REM deprivation in terms of movement response increases and in increases in pathognomic verbalization.

4. The Effect of Day-Night Spontaneous Fantasy

   Subjects who report the greatest propensity to engage in day and night fantasy will be less affected by the REM deprivation condition with smaller increases in movement responses and smaller increases in pathognomic verbalization.

5. Task Irrelevant Fantasy

   a. REM deprived subjects will be more prone to the intrusion of task irrelevant fantasy when performing a cognitive task.

   b. Field dependent Ss will be more prone than field independent Ss to the intrusion of task irrelevant fantasy when performing a cognitive task.

In summary, these hypotheses relate to whether or not REM deprivation affects behavior of a selected kind in a

subsequent waking period. They also attempt to relate organismic variables, i.e., field dependence and the degree to which an individual ordinarily engages in day-night dream activities, to the magnitude of the subsequent effects of REM deprivation.

CHAPTER II

METHOD

This investigation was designed around a host study being conducted at the sleep laboratory of the City College of New York by Dr. Arthur Arkin and Dr. John Antrobus. The host study involved subjects in a laboratory sleep situation in which REM time was systematically reduced. These Ss were awakened in Stage II sleep in order to recover any mentation that was still available in memory. These Stage II awakenings were unrelated to the purposes of this study, but they need to be recognized as part of the procedures which might interact with the results that were obtained. Of course, the same procedures and timing were used during experimental and control awakenings. This theoretically should eliminate any biasing of the results.

For the purposes of this experiment, the subjects were examined on three separate occasions. (1) The first laboratory session was for the purpose of making the S aware of and comfortable with laboratory procedures. During this session, the S was tested to determine his field dependence characteristics and was trained in performing a task which would later be used to measure amount of task irrelevant fantasy experience. (2) Following three subsequent nights of laboratory sleep in which systematic

reduction in REM was accomplished, the S was tested with Holtzman inkblots and performed a cognitive task in which unrelated fantasy was reported. (3) The same tests were applied at a later date following three laboratory sleep nights in which no REM reduction occurred. A fourth aspect involved a questionaire by means of which the S estimated the quantity of day and night dreaming which he normally engaged in. This comprised 24 questions, Part II of the Singer and Antrobus, Imaginal Processes Inventory. This part of the inventory was completed at home and returned to the laboratory at the second laboratory night.

Good design practice would suggest that Ss should be alternated with some experiencing the REM deprivation condition first and others the control condition first. However, there is great individual variability in the number of wake-ups required in order to effect sufficient REM reduction, and it therefore becomes necessary to actually carry out the REM reduction procedures before the control condition can be tailor made for each S. Practically, control of order effects must be sacrificed in order to control for the amount of sleep interference introduced by the experimental conditions. For each S, sleep interference is introduced into his control condition to balance that required for REM deprivation. The design is thus a compromise in which control of order effects must be sacrificed in order to equalize the amount of

sleep disruption across conditions.

A. SELECTION AND DESCRIPTION OF SUBJECTS

The subjects of this experiment were selected from a college population of male graduate and undergraduate students who applied for the study through the college placement office at Columbia University. The Ss were all in their early 20's, attending school at Columbia University. Each S was paid $135.00 for completion of the entire study. However, in the event that an S elected not to continue once his participation had begun, he would not be paid except for $15.00, which was considered payment for the introductory night. No applicants were eliminated by the E, but three eliminated themselves because they felt the procedures were too difficult for them. In all cases, this occurred during the introductory night in the laboratory. The N of 19 Ss for this study was dictated only by the availability of the Ss from the host study. No special requirements were made, and it is unlikely that any could have been tolerated by the host study. This resulted in certain problems in the distribution of scores on subject variables.

B. GENERAL OVERVIEW

1. Apparatus

The specific apparatus for determining field dependence and for measurement of TIF are discussed below in the relevant sections. For purposes of monitoring the oc-

currence of REM, as well as other sleep stages, the Ss were connected to an eight channel Beckman Dynograph. Four channels were used for measuring vertical and horizontal eye movements, two channels for measuring electroencephalographic potentials, one channel for measuring body movements, and one channel was used for recording penile erections. The S slept in a separate room and was contacted only through an intercom. Awakening the S was accomplished by ringing a bell, which could be stopped by the S. This required that a wrist conditioner be squeezed and held for at least two seconds.

2. Method

The S spent seven nights in the laboratory, the first of which was used to acquaint him with the procedures and adapt him to the laboratory. In addition, he was tested with the miniature rod and frame apparatus for field dependence and underwent training procedures for use in the task irrelevant fantasy portion of the experiment. These are described below in the appropriate section. Following these procedures, the S was given a questionaire, which he was to fill out and return at the next laboratory session. He filled out a second form, which asked him about his food intake prior to coming to the laboratory, the amount of alcohol and coffee, and whether or not he was on any kind of medication. He was also given an instruction sheet

about his activities outside of the laboratory. He was told not to nap during the day, that he was to go to sleep at 11:00 p.m., and to get up at 7:00 a.m. Following this, electrodes were applied, and the same wake-up procedures were followed as he was to experience on subsequent laboratory nights.

Approximately three nights following the orientation, the S returned to the laboratory, filled out the form concerning his eating, drinking, and possible medication, had the electrodes applied, and went to bed. No S reported the use of medication, which would have disqualified him. Sleep time for the night was nine hours, allowing one hour for the wake-up interruptions with an expected net sleeping time of eight hours. The hours were 11:00 p.m. to 8:00 a.m. Once the S was asleep, he was awakened each time he entered a REM period and displayed two rapid eye movements. Awakening was by a bell, which could be quieted by squeezing the wrist conditioner for two seconds. Thirty seconds later, the buzzer again rang, and the same procedure was followed to quiet the bell. For purposes of the Arkin-Antrobus study, the S was awakened again in Stage II sleep. This would occur five minutes into Stage II sleep following REM. A second Stage II awakening then occurred five minutes into the next Stage II occurrence. At each of these awakenings, mentation reports were elicited from the S. Approximately three pairs of such Stage II awakenings

occurred during the night. The elicited reports were according to the following series of tape recorded questions:

1. Tell me everything that has been going on in your mind.

2. Was it a thought, image, or dream?

3. Was it extremely vivid, clear, clear half the time, clear in a few spots, or unclear?

4. Describe any emotions you were aware of.

The same procedures were followed for the next two nights. Each morning, the S was asked to fill out a dream log describing all the dreams that he could remember of the previous night. When this was done on the third morning following the third night of REM deprivation, after the electrodes had been removed and he had dressed and washed and had taken some juice, the S was given one set of the Holtzman inkblots as described below in the appropriate section. When this was completed, he entered the TIF chamber, and the task irrelevant fantasy determination was made. The S then spent three nights sleeping at home on the schedule provided by the instructions, kept a dream log, and returned to the laboratory to repeat the procedures for three more consecutive nights. These latter three nights are considered the baseline nights, and they differed from the first three laboratory nights in that REM awakenings were not made, but the same number of awakenings that had been necessary for REM deprivation were now spaced out

in Stage II for each corresponding night. The Stage II mentation report procedures remained the same. On the morning following the third baseline night, the same testing schedule was followed. The fact that deprivation and baseline order could not be reversed simply was recognized as a compromise in the design. It was first necessary to determine the number of REM awakenings which would be required for REM deprivation before the number of awakenings for the baseline series could be determined.

C. MEASUREMENT OF SUBJECT VARIABLES

1. Field Dependence

a. Apparatus

Field dependence was measured in this study with the aid of a portable rod and frame apparatus designed by Philip Oltman at the Downstate Medical Center. The particular unit that was used in this study was purchased from the Darro Products Corporation of Long Island, New York. The apparatus simulates the conditions that an S experiences in a conventional rod and frame test. The device is essentially a horizontal tube which can be rotated through 28 degrees each side of the center. The end of the tube is asquare and constitutes the frame. At this same end of the tube is a disc on which a straight line is clearly marked. The disc is independently rotatable and is such that the plane of the line always passes through the center of the square. The subject views the rod and frame from the op-

posite end of the tube. His head is continuously positioned by means of a chin rest and restraining strap. When the S has placed his head in the rest, he cannot see outside of the apparatus, and the only light available comes through the translucent plastic material of the cylinder.

Use of the portable rod and frame apparatus yields results which correlate highly with standard rod and frame measurements. Oltman (1968) reports a .89 correlation and a Spearman-Brown reliability of .95. Correlation with Witkin's embedded figures test is reported as .60.

b. Procedure

The S is seated in front of the apparatus, which is on a sturdy table. He is positioned so that he does not make contact with the table, with his feet planted flat on the floor, and with his hands resting on his lap. He is instructed to tell if the line is vertical, and if not, in which direction the E should move the line in order to make the line vertical. When the S is satisfied that the line is vertical, a black curtain is raised, shielding the rod and frame from the view of the S. A new adjustment is then made, the curtain lowered, and the S is again asked to tell if the line is vertical or to instruct the E on the direction in which the line should be moved to make it vertical. The E made all adjustments in small, approximately three degree, steps until the S asked for finer adjustments. Since the time for this test is short, approximately 10 min-

utes, no subject had difficulty in maintaining the required posture for the full period.

The S was required to respond to eight settings of the rod and frame, which constituted all combinations of 28 degree departures from vertical for both the rod and the frame repeated 2x for each setting. The score for each trial was the number of degrees from actual vertical for which the S subjectively experienced the line to be vertical. Of course, for each setting, the frame remained at a 28^{o} position rotated left or right of the center position. The relative field dependence is taken as the sum of the eight settings. Details of subject instructions and the eight settings are included in the appendix.

2. Day-Night Dream Frequency

Day-night dream frequency, or I-frequency as it is called in this study, is a quantitative estimate of the degree to which an S normally engages in day and night dreams. The estimate is developed from the self report of the Ss. After the S had completed his first orientation night in the laboratory, he was given the Imaginal Processes Inventory of Singer and Antrobus (1966) and asked to fill out Part II at home and return it on the first experimental night. This section of the inventory allows the S to estimate the quantity of day and night dreaming he spontaneously experiences in his everyday living. The self rating of the subject

is on a five point scale. Typical examples are:

I daydream

1. infrequently
2. once a week
3. once a day
4. a few times during the day
5. many different times during the day. Or:

I recall my dreams vividly

1. rarely or never
2. once a month
3. several times a month
4. several times a week
5. once a night.

The score for I-frequency is the sum of the scores on the 24 individual items. The range of possible scores for an individual S is 24 to 120. The subjects were divided into a high imaginary (HI) and low imaginary (LI) group by eliminating the middle three ranks. This same procedure was followed in dividing the field independent from the field dependent groups.

D. DEPENDENT VARIABLES

1. Movement

On the morning following the third REM deprivation night, the S was administered 22 cards of the Holtzman ink blots, form A. Two sets of plates were made up, one set

consisting of all odd numbered plates from 1 to 43, and the second set consisting of the even numbered plates from 2 to 44. Plate 45 was not used. The sets were alternated, such that every other S was administered the odd numbers, and the subjects in between received the even numbers. The instructions to the S were simply to tell anything in the ink blot that looked like anything and to give two things for each card. After the two responses were given for any plate, the inquiry was immediately made. The inquiry was limited to a single question: "Please describe it to me." No other data about the responses were elicited. Occasionally, while describing his response, an S gave an additional response or noticed something else that he had not seen before. These additionals were not scored.

On the morning following the third baseline night, the S was again administered 22 Holtzman ink blots, but this time the alternate set of cards was used. Those who had responded to the odd numbered cards following deprivation, responded to the even numbered cards following the baseline series, while the odd numbered cards were administered to those who had originally responded to the even numbers. In all other respects, the administration was the same. All responses were tape recorded and later transcribed for scoring purposes.

a. Scoring

Scoring of the typewritten protocols was

accomplished by one trained individual who had considerable experience in rating and scoring mentation reports of subjects, but who did not ordinarily deal with projective techniques. The scorer was urged to apply the criteria in as direct and straight forward a manner as possible. All protocols were coded by a random procedure so that baseline and deprivation performances by the same individual were not distinguishable except by the use of a code sheet. Two sets of scores were developed as described below. The entire set of 38 protocols were scored according to the first set of criteria, and when this was completed and the data turned over to the experimenter, the protocols were returned to the scorer, and the second set of criteria was applied to the data. The scorer was not given any information as to the purposes of the experiment nor any identifying information which would reveal the identity of the participant Ss.

(1) Lerner's Scoring System

Lerner (1966) developed a scoring system for movement which was based on, but not identical with, standard Rorschach methodology. In particular, Lerner cites Beck (1961) and Klopfer and Kelly (1942). Lerner's system is a weighted scoring procedure in which human, animal, and inanimate movement are included. The thrust of the scoring is to recognize empathic kinesthesia in the S's response. It is the kinesthetic experience which

is scored rather than the overt physical expression implied by the response. Thus, active as well as passive responses may be weighted equally. Accordingly, the following schedule was employed:

Weight of 2: A score of two was given for any clear human movement response in which postural kinesthesia was implied. The score of two could be given for both active or passive stances. Thus, "a man running" or "eyes peering" or "someone lying absolutely still" would receive a score of two. Conventional poses, in which the empathic kinesthesis was in doubt, would not be scored two. Thus, "people standing" or "people facing each other" or "people sitting" would not qualify for a two, but "people sitting huddled together" would receive the full score. Animal or inanimate movement could also be given the full two credits if, in the first case, the activity was clearly movement that could only be ascribed to humans. Thus, "two bears arguing" would be scored the full two. In the second case, very clear and forceful inanimate or abstract movement could receive a credit of two. Thus, "a violent explosion; shattering debris everywhere" would be scored two.

Weight of 1: A score of one was given for the unembellished conventional positions that humans may assume. Thus, as indicated above, "people standing" with no further indication of movement or empathic kinesthesia would receive the score of one. However, "people standing

very still" would fall into the two category. Clear animal movement which is not distinctively human is scored one. Movement which is embedded in an art concept, such as a "painting of ..." or a "statue of ..." is scored one, unless the art concept is of only secondary importance brought in to deal with a detail not involved with the movement, in which case the normal scoring rules hold. Also, clear inanimate or abstract movement in which great force or intensity is not indicated is scored one.

Weight of 0: Responses that include equivocal animal movement such as "a dog standing or sitting" or conventional descriptive phrases, such as "an airplane flying" or "a duck swimming" are scored 0, unless sufficient additional embellishment is given to indicate some sort of empathic kinesthesia. Similarly, art concepts without enlivening attitude or activity are scored 0. Thus, a "statue with outstretched arms" is scored 0, but "a statue with outstretched arms beckoning to someone" is scored one. Equivocal inanimate movement, such as "atom bomb blast", where the response seems to be determined by the conventional shape or color would be scored 0.

(2) Holtzman's Scoring System

Holtzman's scoring system is identical with the criteria described by Holtzman, Thorpe, Swartz, and Herron (1961) in Inkblot Perception and Personality. Scoring on a five point scale is based on the dynamic energy

projected into the percept by the S. The following five anchor points for scoring are abstracted from Holtzman, et al. (1961):

> "0 - no movement or static potential for movement
>
> 1 - static potential for movement, as indicated by such participles as sitting, looking, resting, lying
>
> 2 - casual movement, such as walking, talking, climbing, reaching
>
> 3 - dynamic movement, such as lifting, dancing, running, weeping
>
> 4 - violent movement, such as whirling, exploding." (p 51)

In cases where the percept indicates a high state of tension, the scoring is based on the energy investiture not the actual movement. Thus, "two men locked in a fierce arm wrestle" would score three in spite of the limited movement.

2. Pathognomic Verbalization

Pathognomic verbalization, in this study, represents a third set of operational criteria applied to the ink blot protocols. No additional experimental procedures were required. The S's pathognomic verbalizations are essentially responses which are governed by more autistic needs or pressures and have become "loose" with respect to the fit of the percept with reasonable interpretations of the ink blot stimuli. Nine categories of pathognomic verbalizations

are extensively elaborated in the Holtzman, et al. (1961) manual. A five point scale, ranging from 0 to 4, is applied for each response that falls within one of the nine categories. Since certain responses are inherently more serious from a diagnostic standpoint, if they are scored at all, they are given a high score. One such example is "incoherence", which is always scored 4. The category labelled: "fabulation" is never scored higher than one. The nine categories, with the possible range of scores as given in the Holtzman manual, are given below:

Category	Possible Scores
Fabulation	1
Fabulized combination	2, 3, 4
Queer response	1, 2, 3
Incoherence	4
Autistic logic	1, 2, 3, 4
Contamination	2, 3, 4
Self reference	2, 3, 4
Deterioration color	2, 3, 4
Absurd response	3

The ink blot protocols were scored for this variable by a single rater who had no previous experience with this study. The rater was a graduate student in speech pathology who had acquaintance with administering and scoring tests. She was asked to apply the criteria in as straightforward a manner as possible. Only the original responses of the S were scored, and in those one or two cases where additionals were given, they were ignored.

a. Scoring

Each response was scored by direct applica-

tion of the scoring manual, which is reproduced in its entirety in the appendix. However, because the manual is extensive, only a few examples are given here. Fabulation (score 1): Feelings, motives, and similar affective qualities are ascribed to the percept in an usual manner. An example from the manual is, "a kind monster - eyes, and he looks real sweet." Fabulized combination (score 2, 3, or 4): An impossible or fantastic combination of otherwise acceptable parts, based largely on a spatial rather than a logical relationship. An example from the manual, "Two women with feathers. They look like they have old time phonograph horns for heads." Queer response (score 1, 2, or 3): Responses which are deviant in terms of the concepts, language and syntax used. An example from the manual, "Cabbage bed - full of cauliflowers and cherries." Incoherence (score 4): Complete breakdown of rational control. An example from the manual, "A crocodile top - a shell fish. Forms the lines of the earth. Something like a V." Autistic logic (score 1, 2, 3, or 4): Faulty or fantastic reasoning given as justification for the response. Included in this category are Rorschach confabulation responses where a small part of the plate is responsible for a percept which is ascribed to a much larger area to which it bears no resemblance. An example from the manual, "Two toadstools growing up out of trashy-looking mess - that is why they are toadstools." Contamination (score 2, 3, or 4): Two

conflicting interpretations are fused into one, or the same area is used for logically different concepts. An example from the manual, "Must be a cricket - a man cricket. Shaped like crickets and men." Self reference (score 2, 3, or 4): The response is given a personal meaning that shows a loss of distance between the S and the ink blot. An example from the manual, "A man. I haven't got the strength to tell him what to do. He can't decide because he is old." Deterioration color (score 2, 3, or 4): Loose, fantastic color associations. An example from the manual, "Pelvis, unborn. Yellow is dormant - red for living blood." Absurd response (score 3): Responses which completely disregard form where the form cannot be ignored. Examples of this kind of response cannot be appreciated without reference to the actual ink blots. For plate 36A, a percept of the Empire State Building falls into the category.

The final pathognomic verbalization score is simply the sum of the scores on each response which falls within one of the nine categories.

3. Task Irrelevant Fantasy

a. Apparatus

The apparatus for measuring task unrelated fantasy consisted of two main groups. One group was the subject's chamber and signaling devices, while the second was the control and counting section. The S's chamber was a

sound attenuated room in which there was a comfortable chair, a table on which signaling buttons were conveniently arranged, a set of headphones, and a microphone. The headphones served a dual function in that they could be used as part of the intercom system between experimenter and S and were also used to bring auditory signals to the S during the testing phase. In the control room were provisions for sending auditory signals to the S, white noise background to further attenuate interferences from outside sources, and counters for scoring the responses of the S. Audio signal generators provided pure tones which were gated through the mechanism in .1 second bursts according to a punched tape program. The apparatus was so arranged that the S would hear either a high audio tone, a low audio tone, or a combination of both the high and the low tone. Between tones, white noise was always generated and fed through the phones by a white noise generator. The S's responses were designed to be made through the signaling buttons, and verbal communication through the intercom was only for giving instructions. Depressing the left hand button resulted in a correct response being recorded when the low tone was sounded; depressing the right hand button resulted in a correct response being recorded when the high tone was sounded,and depressing both buttons simultaneously would result in a correct response being recorded when both tones were sounded together. Both buttons were close enough together so as to be easily manipulable

with one hand. A third electrical switch was located above and behind the two signal response buttons. This switch could be moved to the right or left. Movement to the left was recorded as "no," signifying that the S had not been aware of any task irrelevant fantasy for the interval just being concluded. Movement to the right was recorded as "yes," signifying that the S had become aware of task unrelated fantasy during the interval just being concluded. Whenever this switch was activated in either direction, it also served the function of starting the punched tape program for another series of tone presentations.

b. Method

When the S arrived at the laboratory on his get-acquainted night, he was introduced to the chamber and the function of the various controls that he would have to operate. The S was then introduced to the operational criteria of fantasy, as it is defined for the purposes of the experiment. In essence, he was told that any thought that might occur to him while he was detecting and responding to the auditory signals was to be considered an intrusive thought if it was not directly a function of the task he was trying to accomplish, or if it related to another period of time, even the immediately preceding interval, or the next expected interval. The wording of the instructions was not exact, but a number of examples were given so that it could be determined with definiteness that the instructions were

understood. Examples included such statements as, "You just thought how difficult a time you were having keeping your mind on the tones." The S was expected to recognize that this was not an irrelevant thought since it pertained directly to the task and its accomplishment. A second was, "You began to realize that you had done poorly during the last interval or two." This is a task irrelevant thought since it pertains to a period of time other than the one in which the detections were being made. Outside noises, which the S became aware of, were not to be considered as task irrelevant thoughts, but if they were recognized and triggered associations, then they were to be reported as TIF. Thus, the roar of a truck going by would not be considered as TIF,but if it made one think of a highway with automotive traffic, then it did qualify as TIF. The S was further informed that it did not matter whether the TIF he experienced was only for a fleeting instant or occupied the entire interval, that in either case he was to indicate the occurrence by a "yes" signal.

The second phase of training for this part of the study involved the S responding to a practice tape which was similar to the punched tape program that would be used on the experimental nights. The S sat in the sound attenuated, darkened chamber and responded to the auditory signals by depressing the keys. Three rates of presentation of the tones were used, starting with the slowest rate of one

detection in five seconds. The second and third rates were one tone per one second, and one tone presentation in 0.5 seconds. The tones were completely randomized to avoid any pattern which could be learned. The tones were presented for 15 second intervals, at which time, the apparatus would automatically stop and remain stopped until the S had indicated by means of the electrical switch whether or not there had been an occurrence of TIF. The S went through the entire series consisting of 12, 15 second intervals at each rate of speed. The series was repeated as often as necessary until the S was able to respond with at least 60% accuracy at each of the speeds of presentation. At intervals, the S was queried about the TIF that he indicated, in order to be sure that the criteria were understood.

On the morning following the third REM deprivation night, and on the morning following the third baseline night, the experimental punched tape program was presented starting with the slowest speed. No practice was permitted, but prior to beginning, the definition of TIF was again given to the S.

c. Scoring

The TIF score at each rate of signal presentation was simply the number of 15 second intervals for which the S indicated that some amount of TIF had occurred. Both the TIF and the accuracy of performance were available on printouts for subsequent inspection and further tabulation.

CHAPTER III

RESULTS

A. MOVEMENT

Hypothesis I states that subjects who are REM deprived will respond to a Rorschach-like ink blot test with more movement responses than would be characteristic for them under non-REM deprived conditions. Two different sets of operational criteria for movement scoring were considered, one identical with those of Lerner (1966) and the second taken from the Holtzman Ink Blot Test Manual (Holtzman et al., 1961). This latter scoring system was used by Clemes and Dement (1967). Lerner found a significant increase in movement scores following REM deprivation, while Clemes and Dement found a significant decrease.

From the two sets of scores, Lerner-M and Holtzman-M, differential scores were developed simply as the difference between the score obtained under REM deprived conditions and the score obtained under baseline conditions. In this way, each subject is his own control and a "t" test for related samples is proper for evaluating the differential scores obtained. In Table 1, the deprivation mean movement scores are shown along with the means of the difference scores and the SD's of the differences. The number of subjects whose scores were in the direction of the hypo-

thesis, opposite to the hypothesis, and for whom there was no change, are shown in the columns marked N+, N-, and No. The total N (Nt) = 19.

In the case of the Lerner-M, it is immediately obvious that the mean difference is negligible. Also, the number of subjects whose differential scores were in the direction of the hypothesis is almost the same as the number of subjects whose differential score was opposite to that of the hypothesis. In the case of the Holtzman-M scoring, the mean difference score of 3.79 reaches a p value between .10 and .15. Thirteen subjects show differential scores in the direction of the hypothesis while only six are in the opposite direction. The binomial probability of 13 differential results out of 19 occurring in the same direction agrees closely with the "t" test. The probability is p = .11, 2 tail.

The results of the Holtzman scoring are thus suggestive of an effect of REM deprivation on M responding. The direction of change is toward greater production of movement responses following REM deprivation. A significant result in this direction would not support the work of Clemes and Dement (1967) who found an opposite effect, but would be supportive of Lerner (1966).

Frequently, a score on a dependent variable can be transformed by any of a number of procedures in such a way as to more accurately reflect true departures from the

TABLE 1

MEAN MOVEMENT SCORES FOLLOWING REM DEPRIVATION AND BASELINE CONDITIONS USING LERNER-M AND HOLTZMAN-M SCORING

	REM Dep Mean	Baseline Mean	Diff Mean	SD	N+	N-	No	Nt
Lerner-M	22.79	21.95	.84	1.81	9	8	2	19
Holtzman-M	32.84	29.05	3.79*	2.01	13	6	0	19

* $.10 < p < .15$

null hypothesis. In the case of the data of this experiment, such a transformation seemed both feasible and advisable. Inspection of the Holtzman-M scores under baseline conditions shows a range of scores from a low of 6 to a high of 64. It is apparent that under experimental conditions an increase of 3 or 4 points over the low score of 6 would have a greater psychological meaning than the same increase over the high score of 64. The difference score, while not incorrect, fails to account for the fact that some Ss tend to give M responses easily, while for others, M responses are relatively rare. In the case of the former, it should be necessary for the absolute differential score to be greater in order to demonstrate a true psychological effect. Although it was not pre-planned in the original statistical design of the experiment, a second set of scores was developed. These scores compared the absolute differential between baseline and deprivation performance to the S's propensity to give M responses. The operational criteria for this M-propensity was taken as the sum of the baseline and deprivation scores for each S. The second set of scores are, thus, proportions of these sums. The differential score is in effect divided by the measure of M-propensity. The scores are labelled LADS and HADS for Lerner Adjusted Differential score and Holtzman Adjusted Differential score respectively. An S, whose post-baseline M score is 10 and post-deprivation M score is 15, would

have an adjusted differential score of 5/25 x 100 = 20.00. For the sake of consistency, the same procedures were applied to the pathognomic verbalization scores.

Table 2 gives the adjusted mean movement scores, the difference means, the standard deviations, and the number of subjects whose scores were in the direction of the hypothesis (N+), opposite to the hypothesis (N-), and for whom there was no change (No). The total sample is Nt = 19. In the case of the LADS scores, the difference mean of 5.09 is nonsignificant with a p = 0.3. However, in the case of the HADS scores, the difference mean of 10.10 reaches a p value of .05, 2 tail.

The same transformed scores, HADS and LADS can also be evaluated by a non-parametric technique, and as a further check, this was done. The results shown in Table 3 are for the Wilcoxen signed ranks test of significance. The Wilcoxen takes into account the direction and rank of each score, but loses data in that the magnitude of the score is not taken into account. However, it does not make any assumptions about normal distributions of populations and thus cannot be challenged on this basis. The results of the Wilcoxen applied to the HADS and LADS data are confirmatory of the significance of the HADS scores and of the chance results of the LADS scores. For HADS, a p value of .06, 2 tail is obtained, which is indeed very close to the p = .05 obtained using the t test for related measures.

TABLE 2

MEAN ADJUSTED DIFFERENTIAL MOVEMENT SCORES (LADS AND HADS) FOR BASELINE AND REM DEPRIVATION CONDITIONS

	REM Dep Mean	Baseline Mean	Diff Mean	SD Diff	N+	N-	No	Nt
LADS	52.54	47.45	5.09		9	8	2	19
HADS	55.05	44.94	10.10*	6.48	13	6	0	19

* p = .05, 2 tail

TABLE 3

HADS AND LADS SCORES EVALUATED
BY WILCOXEN SIGNED RANKS
NON-PARAMETRIC TEST

	+E Ranks	N+	-E Ranks	N-	No	Nt	E(t)	Z
HADS	141	13	49	6	0	19	95	1.86*
LADS	112	9	75	8	2	19	76.5	.07

* p = .06, 2 tail

Thus, there is support for the hypothesis that REM deprivation leads to increased movement responses on a Rorschach-like task. However, the operational definitions of movement must be as described by Holtzman, et al. (1961).

B. PATHOGNOMIC VERBALIZATION

The second hypothesis related to the quality of the verbalization to be expected under REM deprived conditions. Specifically, it was expected that a subject would show increased tendency toward pathognomic verbalization following REM deprivation. Pathognomic verbalization is indicative of the extent to which the perceptions of the individual are governed by inner needs and pressures to the detriment of realistic evaluation of the ink blot material with which he is confronted. As described in the methods section, pathognomic verbalization is scored according to the system of Holtzman, et al. (1961). Clemes and Dement (1967) found a significant increase in pathognomic verbalization following REM deprivation.

The same statistical evaluation procedures are used in evaluating the pathognomic verbalization results as were employed for evaluating the effects of the experimental procedures on movement responses. In the first instance, the absolute differential between the deprivation and baseline scores are evaluated by a "t" test for related samples. A transformation to an adjusted differential score is then made, and the results are again evaluated. These compari-

sons are shown in Table 4. The deprivation and baseline means, the difference means, and standard deviations, and the number of subjects that fall into the several categories, N+, N-, No, and Nt are given. N+ is the number of subjects whose scores are in the direction of the hypothesis. N- is the number of subjects whose scores are opposite to the hypothesis, and No is the number of subjects who showed no change. The total N is 19. In Table 5, the data for a Wilcoxen signed ranks non-parametric test are given for the PADS data. E(t), the expected sum of ranks, the difference between the expected sum of ranks and the smaller of the sums obtained and the standard deviation of the statistic are given. All results (Table 4 and Table 5) are in the direction of the hypothesis, but the adjusted differential scores yield a smaller probability. For the absolute differential, the p value is between .10 and .20. For the adjusted differential score, evaluated by "t" test for related samples, p is between .05 and .10. Using the non-parametric Wilcoxen, the p value is .08. While not achieving significance at the .05 level, the data is suggestive.

In order to gain some understanding of the psychological meaning of this result, it is instructive to note that Holtzman, et al. show a mean PV score of 6.26 and an SD of 8 for a standard administration to a normative college population, yielding 45 responses per S, one per ink blot.

TABLE 4

MEANS OF PATHOGNOMIC VERBALIZATION (PV) AND PV ADJUSTED DIFFERENTIAL SCORE (PADS) FOR BASELINE AND REM DEPRIVATION SCORES AND MEANS AND SD's OF DIFFERENCE SCORES

	REM Dep Mean	Baseline Mean	Diff Mean	SD	N+	N-	No	Nt
PV	14.63	10.26	4.37*	3.33	12	5	2	19
PADS	58.81	41.19	17.62**	9.84	12	5	2	19

* $.10 < p < .20$
** $.05 < p < .10$

TABLE 5

EVALUATION OF PADS REM-DEP AND BASELINE SCORES BY WILCOXEN SIGNED RANKS NON-PARAMETRIC TEST

+E Ranks	N+	-E Ranks	N-	No	Nt	E(t)	Et	Z
113.5	12	39.5	5	2	19	76.5	21.11	1.65*

* p= .08, 2 tail

The Ss in this experiment gave 44 responses at each administration, 2 for each of 22 cards. The total number of responses is close, but the administration differs in this respect. One hundred chronic schizophrenics had a mean score of 30.31 with an SD of 46.09 on a standard administration. The mean PV score, under baseline conditions, for the 19 Ss is 10.26, while under deprivation conditions the mean PV score increases to 14.63. It is thus apparent that the increase in pathognomic verbalization bespeaks a moderate move toward more autistic perception.

C. FIELD DEPENDENCE - INDEPENDENCE

Hypothesis III states that REM deprivation will have less effect on field independent than on relatively field dependent subjects on both of the dependent variables, movement and pathognomic verbalization. This hypothesis has both face validity and is supported by the work of Cartwright (1966) and Cartwright, Monroe, and Palmer (1967). It would seem that a field independent subject would better distinguish between inner pressures and the outside perceptual world. If, indeed, the REM deprivation procedures result in the creation of inner pressures, then it would make sense that field independent subjects, recognizing what is inside and what is outside, would be less prone than a field dependent subject to modify his baseline behavior. Cartwright, et al. found that their field independent subjects were least

likely to be affected by a hallucinogenic drug and showed the least tendency to produce dream-like content from other stages of sleep.

Table 6 shows the movement and pathognomic verbalization differential scores for the relatively field independent and the relatively field dependent subjects of this experiment. Table 7 shows the same data converted into HADS, LADS, and PADS scores. Of the 19 subjects, 16 were used in this analysis. These included the highest and lowest scorers on the rod and frame test, with the middle subjects eliminated. As Table 8 shows the two groups are not widely separated, the field independent group on the average placing the rod 1.08 degrees (SD = .32) from vertical, while the relatively field dependent group placed the rod 4.66 degrees (SD = .97) from vertical on the average. Considering that the two groups are close in their field dependent characteristics, it is to be taken seriously that a significant difference in the PADS scores did develop. The probability of the null hypothesis is $p = .05$, 2 tail. However, the direction of the result is opposite to that predicted by the hypothesis, that is, the pathognomic verbalization increased relatively more for the field independent group than it did for the field dependent group. The mean score for PADS of the field independent group is 39.45, while the mean PADS score for the dependent group is 5.96. The pathognomic verbalization differential scores also approach

TABLE 6

MEANS AND SD'S OF MOVEMENT AND PATHOGNOMIC VERBALIZATION DIFFERENTIAL SCORES FOR FIELD DEPENDENT AND FIELD INDEPENDENT SUBJECTS

	Field Independent N = 8		Field Dependent N = 8	
	Mean	SD	Mean	SD
* Lerner-M	3.38	9.53	1.00	7.34
** Holtzman-M	6.62	9.64	2.38	9.94
*** Pathognomic Verbalization	13.25	16.40	-2.63	10.67

* $.20 < p < .40$, 2 tail
** $.10 < p < .20$, 2 tail
*** $.05 < p < .10$, 2 tail

TABLE 7

MEAN ADJUSTED DIFFERENTIAL MOVEMENT (LADS & HADS) AND MEAN ADJUSTED DIFFERENTIAL PATHOGNOMIC VERBALIZATION SCORES FOR FIELD INDEPENDENT AND FIELD DEPENDENT SUBJECTS

	Field Independent		Field Dependent	
	Mean	SD	Mean	SD
LADS	10.44	28.5	3.53	10.14
HADS	13.15	23.53	9.80	26.41
PADS*	39.45	18.57	5.96	90.5

* p = .05, 2 tail

TABLE 8

MEAN ROD AND FRAME SCORES FOR FIELD DEPENDENT AND FIELD INDEPENDENT SUBJECTS

	FI MEAN	SD	N	FD MEAN	SD	N
ROD & FRAME	1.08	.32	8	4.66	.97	8

significance when subjects are divided along field dependent-independent dimension. As shown in Table 6, the mean PV differential score for the field independent group is 13.25, while for the dependent group the mean score is -2.63. The probability of the null hypothesis approaches .05, 2 tail. Both sets of scores, the simple differential between baseline and deprivation performance and the adjusted differentials, indicate clearly that the change which takes place is almost entirely due to the increase of pathognomic verbalization of the field independent group. The field dependent Ss, on the whole, show virtually no change in mean score between conditions which the field independent Ss show significant increases in pathognomic verbalization. The increase of 13.25 points for the field independent group between baseline and deprivation performance may be compared with the 6.26 mean score obtained by Holtzman et al. on a standardization group of 206 college students.

D. DAYDREAM-NIGHT DREAM FREQUENCY (I)

Hypothesis IV concerns itself with the relationship of the dependent variables of movement and pathognomic verbalization to the subject's predisposition to engage in day and night dreams according to his self-report. This is called "I frequency" or "I" in this study. The hypothesis states that subjects who are more prone to the spontaneous production of fantasy in daydreams and night dreaming will be less affected by the experimental procedures, that is,

will show smaller increases in movement and in pathognomic verbalization on the ink blot test. If it were borne out, then it would point to the importance of REM mentation as a psychological aspect of the REM state. Thus, it could be hypothesized that Ss who experience more fantasy activity through the daily cycle of wakefulness and sleep would have resources to cope with the postulated stress created by REM deprivation.

I-frequency was determined by the self-report of each S on Part II of the Singer-Antrobus, Imaginal Processes Inventory (1966). All 24 items in this part dealing with the S's estimate of how often he engages in day and night dreaming activity entered into the score. The S estimated frequency on a 5 point scale. Each score is a simple summation of the frequency estimates on the 24 items. The 8 subjects with the highest scores are labelled the "HI" group, and the 8 subjects with the lowest scores are labelled the "LI" group.

Table 9 gives the means for the HI and LI groups, the difference means between the 2 groups, and the SD's of the differences. Table 9 tabulates these means for the differential scores (Movement and Pathognomic Verbalization) and the adjusted differential scores (HADS, LADS, and PADS). Each table entry under "HI" and "LI" represents the mean difference between the baseline and REM deprivation performance for N = 8 subjects. In the case of the 4 sets of

TABLE 9

MEAN MOVEMENT AND PATHOGNOMIC VERBALIZATION DIFFERENTIAL AND ADJUSTED DIFFERENTIAL SCORES FOR HI AND LI SUBJECTS

	HI N = 8 Mean	LI N = 8 Mean	Diff of Mean	SD
Lerner-M	3.00	0.75	2.25	3.90
Holtzman-M	4.87	4.00	0.87	
PV	12.12	-1.00	*13.12	7.28
LADS	3.75	8.36	-4.61	
HADS	13.04	9.41	3.63	
PADS	30.58	13.05	17.53	21.11

* $.05 < p < .10$, 2 tail

scores associated with movement responses, the data is clearly not significant. In the case of the 2 sets of scores associated with pathognomic verbalization, only the differential score (PV) approaches the .05 level, while the adjusted differential (PADS) is between p values of .20 and .40. We have here a suggestion that the HI subjects are more disposed to increasing pathognomic verbalization as a consequence of REM deprivation, while LI subjects are less likely to do so.

E. TASK IRRELEVANT FANTASY

Hypothesis V was designed to further explore the relationship between the processes of REM and the ensuing waking state. If it were found that REM deprived subjects were more prone than non-REM deprived subjects to experience thoughts and images unrelated to the cognitive task in which they might be engaged, then it would indicate that the vicissitudes of REM affect an S in his waking state. In this event, one could postulate some kind of equivalence between the mentation of REM and the waking fantasy. This does not necessarily follow as there is no simple way to separate the physiological and psychological consequences of REM and REM deprivation. On the other hand, if it cannot be shown that REM deprivation leads to changes in subsequent waking fantasy production, it would be pointless to pursue further postulates as to their equivalence or similar function.

The cognitive task which engaged the subject was the detection and discrimination of 3 possible tone combinations to which he listened while sitting in a quiet, darkened room. His task was to determine if a high, a low, or a combination of high and low tones were sounded. He responded by depressing keys electrically connected to a recording apparatus. The tones were presented at various rates, 1 tone/5sec., 1 tone/1 sec., and 1 tone/0.5 sec. The task was broken into 15 second episodes with 12 episodes for each rate of signal detection. For each episode, the subject reported whether or not any thoughts or images came to mind which were unrelated to his signal detection task. The score developed for each signal detection rate was simply the number of episodes in which any unrelated fantasy intruded, perhaps decreasing the amount of attention given the task. Each S thus had 3 scores for the REM deprived condition and 3 scores for the non-REM deprived condition. According to Hypothesis V, it was expected that the REM-deprived condition would yield more instances in which intrusive fantasy occurred.

Table 10 gives the mean task irrelevant fantasy (TIF) scores and SD's for the 3 rates of tone detection for each condition of REM deprivation. It is immediately apparent that the hypothesis is not borne out, since the mean number of fantasy intrusions is greater in every case for the baseline condition. It also appears that, as the task became

more difficult (e.g., higher rate of tone detection), the amount of intrusive fantasy decreased. Thus, under baseline conditions when only 1 detection was required in 5 seconds, the mean number of intrusions was 6.44, but when the number of detections increased to 1 per second, the mean number of intrusions dropped to 5.44, and under the most difficult condition, 1 detection per 0.5 second, the mean number of intrusions became 4.5. A parallel result is seen for the REM deprivation condition. The corresponding means are 5.31, 4.5, and 3.95.

Analysis of the data for significant differences among the 6 means was carried out by a 2 x 3 analysis of variance, repeated measures design. The performance of each subject across the 6 conditions is taken as a block. Table 11 gives a summary of the analysis. The means of the 6 conditions did not differ significantly. However, the main effects, subjects' state of REM deprivation (D_1-D_2) and rate of signal presentation (R_1, R_2, R_3), approach the $p = .10$ level of significance. The data is thus only suggestive in the first case that REM deprivation is not a creator of a need to produce fantasy in the waking state. In fact, it may disrupt that capacity since the S invariably produced more TIF under baseline conditions. The second suggestive result is only that as the cognitive task difficulty is increased, the tendency to permit intrusive thoughts to be generated is reduced. This is a situation

TABLE 10

MEAN TIF SCORES FOR REM DEPRIVED AND NON-REM DEPRIVED CONDITIONS FOR 3 RATES OF SIGNAL DETECTION

	REM Deprived (D_1)		Non-REM Deprived (D_2)	
	Mean	SD	Mean	SD
1 tone/5 sec.	5.31	4.25	6.44	3.60
1 tone/1 sec.	4.50	3.20	5.44	4.70
1 tone/0.5 sec.	3.95	3.90	4.50	2.84

TABLE 11

SUMMARY OF ANOVA TIF SCORES FOR REM DEPRIVED (D_1) AND NON-REM DEPRIVED (D_2) SUBJECTS AT 3 RATES OF SIGNAL DETECTION

Source	SS	df	Mean Sq.	F
Treatments	63.60	5	12.72	1.56 n.s.
Blocks	593.05	15	39.53	
Residual	612.44	75	8.17	
Deprivation $D_1 - D_2$	18.27	1	18.27	2.24 *
Rate R_1 R_2 R_3	43.92	2	21.96	2.68 *
R X D	1.41	2	.70	

* p = .10

which appears independent of the conditions of the experiment.

F. SIGNAL DETECTION ACCURACY

Signal detection accuracy was not considered in the original set of hypotheses, but it would appear to be important to fully assess the experimental results. Each S was trained to respond to the tones until he reached a criterion level of 60% accuracy at each presentation rate. However, there was no way to insure that the Ss achieved a particular level of accuracy during the post-REM deprivation or the post-baseline testing. Thus, it could turn out that the Ss who showed no differences in the production of task irrelevant fantasy might have been showing differential accuracy in performance of the assigned cognitive task. This would not yield any clear hypothesis about the relationship of waking fantasy and REM phenomena, but it would give rise to speculation that the vicissitudes of the REM state affected the later deployment of attention to ensuing cognitive work. If it turned out that the S showed a poorer performance following REM deprivation, then we could speculate that in order for the S to continue the same level of fantasy production under each condition, REM deprived and non-REM deprived, it was necessary for him to sacrifice his attention to the assigned task.

In order to normalize the accuracy scores across the

3 rates of signal detection presentations, the number of correct responses was taken as a percentage of the total possible number of correct responses. Since the episodes were always 15 seconds in duration, the subject responded to 3 presentations (1/5 sec.), to 15 presentations (1/1 sec.) and 30 presentations (1/.5 sec.) in the 3 different rate conditions. Since there were 12 episodes at each rate, there were a possible 36 correct discriminations at the slowest rate, 180 at the medium rate, and 360 at the fast rate. Table 12 shows the mean accuracy scores and SD's. It is clear that the only place where a difference in accuracy develops is at the fast rate of presentation.

A 2x3 analysis of variances was carried out to assess the significance of this difference and to evaluate the interaction effects. The analysis is summarized in Table 13. The points of interest in this analysis are the $D_1 - D_2$ source of variation, that is, whether accuracy of signal detection varies as a function of the state of REM deprivation, and the possible interaction of the rate of signal detection with the state of REM deprivation. Neither of these values approach significance. One is surprised at the consistency of the S's performance in their 2 test experiences. A practice effect which might have developed would have been difficult to disentangle from a main effect.

TABLE 12

MEAN ACCURACY OF SIGNAL DETECTION SCORES FOR EACH OF 3 RATES FOR REM-DEPRIVATION - D_1 AND BASELINE - D_2 CONDITIONS

	REM-Deprived-D_1 Mean	REM-Deprived-D_1 SD	Non-REM-Deprived-D_2 Mean	Non-REM-Deprived-D_2 SD
1 tone/5 sec. (slow)	97.20	3.4	92.65	17.46
1 tone/1 sec. (medium)	89.42	10.6	89.59	10.3
1 tone/0.5 sec. (fast)	57.81	28.62	65.71	17.46

TABLE 13

SUMMARY OF ANOVA FOR SIGNAL DETECTION ACCURACY SCORES FOR REM-DEPRIVED -D_1 and NON-REM-DEPRIVED - D_2 CONDITIONS AT 3 RATES OF SIGNAL DETECTION

Source	SS	df	Mean Sq.	F
Treatments	18.301	5	3660.20	
Blocks	4.881	13	376	
Residual	16.696	65	256	
Deprivation D_1 - D_2	29	1	29	.11 n.s.
Rate R_1 R_2 R_3	17,719	2	8859	
R X D	553	2	276.5	1.07 n.s

G. TASK IRRELEVANT FANTASY VS. DAY-NIGHT DREAM FREQUENCY AND FIELD DEPENDENCE -INDEPENDENCE

Hypothesis V, in the previous section, deals with the relationship between REM processes and fantasy production in the ensuing waking state. The expectation that REM deprivation would lead to an increased tendency on the part of the Ss to experience task unrelated cognitive activity (TIF) was not borne out. Surprisingly, the baseline conditions consistently lead to greater TIF production. However, it was still possible that the field dependent and the I-frequency indices could differentiate REM-deprived Ss with regard to the TIF dependent variable. It was postulated under this hypothesis that the field independent S would be less likely to show increases in TIF. It was felt that the field independent individual would be more in touch with internal body cues and could thus resist pressures to modify normal levels of psychic activity such as the creation of waking fantasies. If the hypothesis was borne out then it would indicate a possible connection between a waking process and the REM state.

The data for the 7 subjects with the highest FD scores and the 7 with the lowest FD scores were evaluated by a 2x2x3 analysis of variance with field dependence (FD-FI), state of REM-deprivation (D_1-D_2), and rate of signal detection (R) representing the main effects of the analysis.

Table 14 gives the TIF means and SD's for the Field

Dependent and Independent Ss for the REM Deprived (D_1) and the non-REM deprived (D_2) conditions. The mean for each of the 3 rates (1/5 sec., 1/1 sec., and 1/0.5 sec.) of signal detection is given separately. Inspection of this table indicates that under the REM deprived experimental condition, there are only slight differences in the TIF scores for the 2 groups. Under REM deprived conditions, the medium signal detection speed means for the FI and FD group is the same, 5.71 fantasy intrusions. At the slow speed the FD mean is 6.86, while the FI mean is 6.43. The biggest difference develops at the highest rate of signal detection, 5.67 for the FD group and 4.29 for the FI group. Under the non-REM deprived condition, the maximum difference is again at the fast rate of signal detection, 5.43 for the FD group and 2.57 for the FI group. The Anova is given in Table 15. No significant F's develop in the analysis either in main effects or in interactions. There is no evidence that field dependence, as an organismic variable, affects intrusive fantasy production differentially as a consequence of an individual's state of REM deprivation.

A similar 2x2x3 Anova was carried out for the 7 Ss lowest in I-frequency (LI) and the 7 Ss highest in I-frequency to assess the effect of imaginative predisposition on TIF production under the conditions of the experiment. The main effects of the analysis are again state of REM-deprivation (D_1-D_2), rate of signal detection (R), and high and

TABLE 14

TIF MEANS AND SD'S UNDER REM-DEPRIVED (D_1) AND NON-REM-DEPRIVED (D_2) CONDITIONS FOR FIELD INDEPENDENT (FI) AND FIELD DEPENDENT (FD) SUBJECTS AT EACH OF 3 RATES OF SIGNAL DETECTION

		REM-Deprived - D_1			Non-REM-Deprived - D_2		
		Slo	Med	Fast	Slo	Med	Fast
FI	$\bar{X}$	6.43	5.71	4.29	6.57	5.14	2.57
N = 7	SD	4.20	5.05	2.36	4.40	3.02	3.69
FD	$\bar{X}$	6.86	5.71	5.67	4.57	3.71	5.43
N = 7	SD	3.70	5.08	4.86	1.86	3.70	4.29

TABLE 15

ANOVA OF TIF SCORES UNDER REM-DEPRIVED (D_1) AND NON-REM-DEPRIVED (D_2) CONDITIONS FOR FIELD INDEPENDENT (FI) AND FIELD DEPENDENT (FD) SUBJECTS DURING 3 RATES OF SIGNAL DETECTION

Source	df	MS	F
D1 - D_2	1	19.86	1.31*
FD - FI	1	0.12	
Rate			
D x FD	1	1.71	
D x R	2	1.01	
FD x R	2	14.16	
D x FD x R	2	10.86	
Total	83		
SS_B	11	10.92	
SS_W	72	15.11	

* p = .25

I-frequency (HI-LI). The main focus of interest are the interaction effects, i.e., whether the "I" variable significantly interacts with state of REM-deprivation in changing TIF production. Table 16 gives the means and SD's of TIF scores for each of the 3 rates of signal detection, divided along the HI-LI dimension and the D_1-D_2 conditions.

Inspection of Table 16 shows that the LI subjects give lower mean TIF scores at each signal detection rate under the REM-deprivation condition. The greatest difference occurs at the medium (1 discrimination/sec.) speed. At this rate, the baseline mean TIF score for the LI subjects is 7.0, while under REM-deprivation conditions, the mean TIF score is 2.86. At the slow speed (1 discrimination/5 sec.), the baseline mean is 6.0, while the deprivation mean is 3.71. Under the fast (1 discrimination/0.5 sec.), the difference in means disappears, 4.0 as opposed to 3.57. The HI subjects do not show the same pattern. At the medium speed, the baseline mean is 4.43, while the deprivation mean is higher 6.71; the slow speed yields virtually the same means, 7.29 baseline and 7.43 deprivation. The high speed presentation yields a TIF baseline of 5.14 compared to a deprivation, 4.43. Thus, on the whole, the HI subjects show less change between baseline and deprivation conditions, and a consistent pattern is absent.

Table 17 is the Anova summary. The I dimension and the D x I interaction are close to significance, in a p

TABLE 16

TIF MEANS AND SD'S UNDER REM-DEPRIVED (D_1) AND NON-REM-DEPRIVED (D_2) CONDITIONS FOR Ss LOW IN IMAGINATIVE PREDISPOSITION (LI) AND Ss HIGH IN IMAGINATIVE PREDISPOSITION (HI)

		REM-Deprived - D1			Non-REM-Deprived - D_2		
		Slo	Med	Fast	Slo	Med	Fast
LI	Mean	3.71	2.86	3.57	6.0	7.0	4.0
N = 7	SD	2.40	2.55	4.12	4.75	4.75	3.25
HI	Mean	7.43	6.71	4.43	7.29	4.43	5.14
N = 7	SD	3.55	1.44	4.35	2.80	4.95	2.97

TABLE 17

ANOVA OF TIF SCORES UNDER REM-DEPRIVED (D_1) AND NON-REM-DEPRIVED (D_2) CONDITIONS FOR HIGH FANTASY (HI) AND LOW FANTASY (LI) Ss DURING 3 RATES OF SIGNAL DETECTION

Source	df	MS	F
$D_1 - D_2$	1	15.29	1.16
HI - LI	1	39.90	3.02*
Rate (r_1, r_2, r_3)	2	23.06	1.74
D x I	1	43.00	3.25*
Dx R	2	0.63	
I x R	2	19.32	
D x I x R	2	12.45	
Total	83		
SS_B	11	19.01	
SS_W	72	13.22	

* $.05 < p < .10$
$P = .1$, $F = 2.79$
$p = .05$, $F = 3.98$

range between .05 and .10. The I result merely suggests that Ss who rate themselves high on the I dimension score differently than Ss who rate themselves low on this same dimension. Inspection of Table 16 shows that taken across both conditions, the HI subjects yield higher scores than the LI subjects. This tends to validate the self-report instrument, the Imaginal Processes Inventory, Part II with respect to amount of task unrelated cognitive activity that an S experiences. Thus, averaging the TIF scores across all rates of signal detection for both D_1 and D_2 conditions, the HI S experience a mean of 5.91 intrusions, while the LI S experience a mean of only 4.5 intrusions. The analysis is suggestive with regard to the significance of this difference.

The D x I interaction is a more important result, suggesting in this case that the I variable discriminates Ss with regard to their response to REM-deprivation. Under baseline conditions, it appears from Table 16 that the HI Ss and the LI Ss produce about the same amount of TIF, that is, across the 3 rates of signal detection, the LI Ss produce a mean score of 5.67, while the HI Ss produce a mean score of 5.62. However, under deprivation conditions, the LI S's overall mean drops to 3.38, while the HI S's increases to 6.19. This differential change is the effect leading to the near significant D x I interaction result. Specifically, there appears to be a differential response to REM-deprivation such that Ss who rate them-

selves low on the amount of day and night dreams they experience in their everyday lives tend to produce less task unrelated fantasy following REM-deprivation while Ss who rate themselves high in this regard tend to increase their TIF following REM-deprivation. In order to further explore this result, Table 18 was developed from Table 16 by taking the differences between deprivation and baseline means for each rate of signal detection. The baseline (D_2) mean is subtracted from the deprivation (D_1) mean. A negative result thus indicates more TIF under baseline conditions, while a positive difference indicates a greater production of TIF under deprivation conditions. As previously indicated, Table 18 shows that for the LI subjects more TIF is produced under baseline conditions and the reverse is true for the HI subjects. If the absolute difference between the means is taken at each rate of signal detection, then it can be seen that the medium signal detection speed (1/1 sec. rate) creates almost the entire difference that develops between the HI and LI subjects. At the fast rate, the difference is -1.1, while at the slow rate, the difference is 2.43, but at the medium rate, the difference is 6.42 fantasy intrusions. Since the 3 rates of signal detection represent 3 different psychological sets toward the task posed by the experimental conditions, it is worthwhile to examine the results separately for the medium rate of speed where the large difference develops. The slow rate of speed is so easy that virtually

TABLE 18

DIFFERENCES BETWEEN DEPRIVATION AND BASELINE TIF MEANS (D_1-D_2) FOR LI AND HI Ss AT 3 RATES OF SIGNAL DETECTION

	Slo 1/5 sec.	Med 1/1 sec.	Fast 1/0.5sec.
LI N=7	-2.29	-4.14	- .43
HI N=7	0.14	2.28	- .71
Absolute Diff	2.43	6.42	1.14

all detections are correct and easily accomplished. Under the fast rate of speed, a subject was able to approach a perfect accuracy score with great difficulty and many subjects did not even reach the accuracy criterion of 60% achieved during the training session. On the other hand, the 1 detection/sec. rate could be accomplished with reasonable but sustained attention. No S failed to meet the learning criterion under these conditions, and many scores were near perfect. A rank order correlation was calculated showing the association of the I-frequency self-report score and the deprivation minus baseline (D_1-D_2) task unrelated fantasy scores under the medium signal detection speed. The scatter diagram representing this correlation is shown in fig. 1. The abscissa of the graph represents the rank order of the I-frequency scores, while the ordinate represents the difference between the deprivation and baseline TIF performance. The upper portion of the ordinate is the positive region, that is, where deprivation TIF score exceeds baseline, while the lower ordinate is the negative region where baseline TIF score exceeds the deprivation score. The rank order correlation is .664 with a p value of less than .05, 2 tail. If this result is replicable, it would seem that Ss who are more prone to experience and recall day and night dreams are also more prone to experience the intrusion of task unrelated fantasy while engaged in an absorbing but manageable task, while the opposite LI subjects

DIFFERENCE BETWEEN DEPRIVATION AND BASELINE TIF

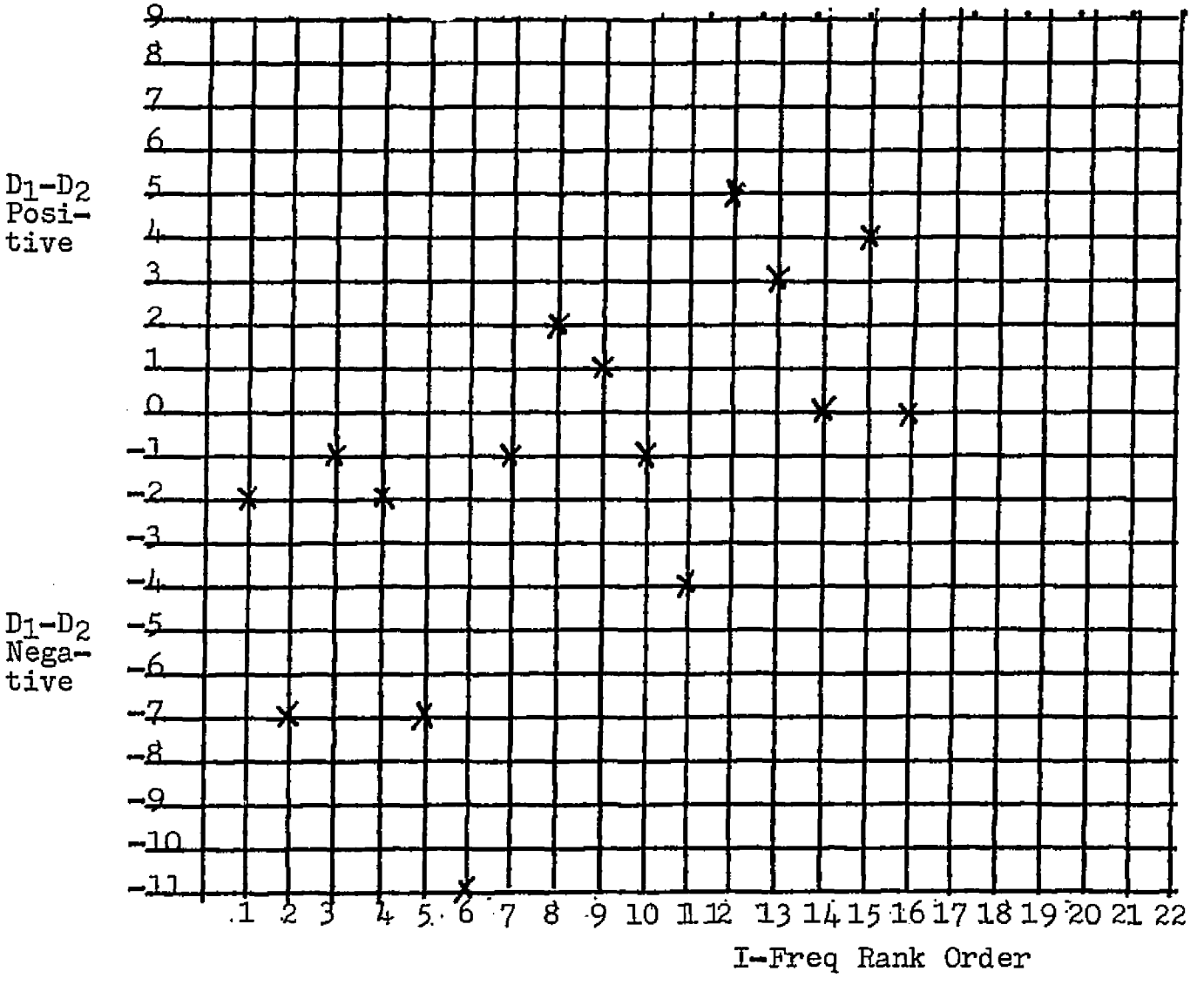

Fig. 1.

Scatter diagram showing the association of I-frequency self-report with the difference in task irrelevant fantasy produced under baseline and deprivation conditions at 1 signal/sec. detection rate. Spearman's rank order correlation $R_r = .664$ $p < .05$.

are disrupted in the production of TIF under the same conditions. These same results do not develop when the task is either very difficult or extremely easy. One might speculate that the occurrence of the fantasy intruding on the task might be less of what is reported by the subject than the fantasy of which he is aware. The signal detection rate may act as a tuning function similar to the way anxiety affects the performance of a task. Too little or too much are less effective than a medium amount. The medium detection speed may create the correct set for capturing the fantasy which does occur.

The sub-hypothesis under V relating the I-frequency self-report with TIF production suggested that HI Ss would be less prone than LI Ss to find task unrelated fantasy intruding on their signal detection task. The implication was that fantasy producers would be able to compensate for REM-deprivation through the use of this capacity, and so would not find task unrelated fantasy intruding upon them. On the other hand, the hypothesis suggested that LI Ss would not have a similar compensation mechanism and would, therefore, be more prone to having fantasy intrude upon them when their attention was diverted. The implication being examined was thus that REM disruption requires compensation and that some kind of rough functional equivalence between REM mentation and other fantasy processes existed. The results, however, are not supportive of the hypothesis

or the implications derived from it. It appears that loss of REM time leads to a disruption in the LI S's production of TIF rather than augmenting it. The HI Ss, on the other hand, do appear to produce more fantasy with loss of REM time. Thus, neither a compensation nor an equivalence theory is supported. What seems most important, however, is the differential response of the HI and LI subjects. This is highlighted by the significant association of the deprivation minus baseline (D_1-D_2) fantasy scores with the I-frequency self-report. The higher the S rates himself on his frequency of day and night dreaming, the more likely is REM deprivation to activate fantasy intrusions above baseline levels in a subsequent absorbing task.

CHAPTER IV

DISCUSSION

The purpose of this study was to examine the intriguing, broad question "are the vicissitudes of REM sleep connected with waking behavioral function?" The evidence that has heretofore been gathered has in some respects have been equivocal and in others contested by counter-interpretations and contradictory results. The Lerner (1966) and the Clemes and Dement (1967) results, with respect to perceived movement in a projective ink blot test, being good examples of the conflicting evidence. The need for further replication and expansion of work in this area was necessary to lend weight to one or another view.

The temptation to equate REM sleep and dreaming is very strong. Many authors implicitly or explicitly equate the effects of REM deprivation with dream deprivation. Dement's pioneer work (1960) in this field was called The Effects of Dream Deprivation; Fisher (1965B talks about the dream breaking through into waking consciousness, and Lerner (1966) states in so many words that even sleep deprivation means dream deprivation. However, this study does not purport to specifically link observed effects of REM deprivation to loss of the dream. For the most part, the REM state is taken as a phenomenon from which the psycholog-

ical manifestations are as yet undifferentiated from the physiological manifestations in our knowledge at least. It may be that what happens during REM is psychobiological in nature, a phenomenon whose interpretation in visual symbols becomes a dream and in physiological "symbols" are the many manifestations that are measured electronically. It is, nevertheless, appropriate to examine waking fantasy processes in connection with REM. Are subsequent fantasy processes affected, or does fantasy affect the consequences of REM? One study (Fiss, Ellman, and Klein, 1969) has presented some evidence that the two, psychology and biology of REM, may actually be distinct and serve unique functions in spite of the seemingly synchronous occurrence. However, the construction of this study does not maximize a possibility of supporting this view, nor does it exclude this intriguing possibility. What can be said is that certain systematic observations have been made when REM sleep is curtailed, and there also appears to be individual differences in response to REM curtailment. Cartwright, Monroe, and Palmer (1967) pointed out that even the REM compensation phenomenon is a function of the individual style of their subjects. Briefly, it could be said that this study may link REM effects to subsequent behavioral processes, but may not dissect REM without considerable speculative risk.

Before discussing the dependent variables, a note on the limitations of the experimental design is in order.

It was noted in Chapter II that counterbalancing the order in which deprivation and baseline data were collected was not a practical possibility in this study. Fortunately, The Holtzman et al., (1961) manual has considerable data with regard to test-retest reliability with the ink blots used to assess the major variables of the study. Data are available for a college population retested 1 week and 1 year subsequent to initial testing with the Holtzman inkblots. The reliability coefficients were significant beyond the .01 level for both of the scoring categories of interest. A quote from the manual best summarizes the situation with regard to movement, "In the case of Movement, for example, one can safely say that the intra-subject stability is somewhere between .67 and .78 for typical college students when the inkblots are given and scored in a standard manner." (p 137) For Pathognomic Verbalization, the data are not as impressive. Because of a skewness in the data, phi coefficients rather than product-moment correlations were computed. A retest after 1 week, yielded a phi coefficient of .45, again significant beyond the .01 level. The manual points out that in all cases, the phi coefficient is a conservative estimate as it is always lower than a product-moment correlation coefficient as a measure of degree of association. It was further determined that the examiner was a significant variable in Pathognomic Verbalization scoring. Since only one E was used in this study, this

source of variation is removed, and we may expect even better stability than that predicted, exclusive of course, of the experimental effects.

A. MOVEMENT

Subjects, who were REM-deprived over a period of three consecutive nights, responded to Holtzman inkblot plates by perceiving significantly more movement in the static ink blots than did these same subjects following three baseline nights. Movement in this case was defined by the scoring system devised by Holtzman et al. (1961) for use with the Holtzman Inkblot Technique. At the same time, the Lerner (1966) scoring system, which leans heavily on Beck (1961) and Klopfer and Kelly (1942), was insensitive to the differences in the subjects' perceptions in this regard. At a first order level, we can simply say that REM deprivation has affected waking perception; and alternatively, that, at least to this extent, REM sleep shapes our relationship to the external world. However, it may also be valuable to apply our understanding of the specific determinant affected in order to give dimension to the observed change.

Schachtel (1950), in analyzing the movement response in the Rorschach, connects it to an individual's characteristic attitude toward his environment and links it with the core of the personality. He argues that when a true movement response is given, it must represent an actual kinesthetic experience, and he likens it to kinesthetic empathy as when

one observes a dynamic posture or movement, as in watching a dance or an acrobat. Since, in fact, the ink blots are static and lifeless, it is only from an inner experience that movement may arise and be imparted to the percept. The actual qualities of the ink blot, it is true, stimulate the kind of perception, but it can only be the inner experience of the S projected onto the ink blot materials that yields a final verbal statement about moving objects related by dynamic forces. When an individual observes a static and lifeless painting depicting a scene which is known to be a moving and dynamic one in its real environmental counterpart, such as rolling ocean waves or animals in flight, it is not surprising that the observer will experience some amount of kinesthetic sensation. This situation we may liken to just "remembering." However, when the stimulating material is composed of relatively ambiguous ink blots which are capable of myriads of interpretations, the final perceptual product must devolve, in large part, from the readiness for kinesthetic sensation already present in the organization of the musculature of the individual. Wilhelm Reich (1949), in his Character Analysis, and Alexander Lowen (1967), in his Betrayal of the Body, gives ample treatment to the way in which psychic structure and conflicts are vested in the musculature and give rise to tensions which in turn give rise to characteristic postures and movements. W. Wolff (1943, cited from Schachtel, 1950), for instance, demonstrated that a

person is more likely to recognize his own gait than his profile or his voice or the movement of his hands, or even the gait of friends whom he has had much more opportunity to observe. In fact, it is rare indeed that one has an opportunity to observe his own gait. We can only conclude that the observer who recognizes his own gait in a figure otherwise disguised must make a comparison on the basis of his inner kinesthetic empathy with the moving picture he is observing. It is possible for us to project ourselves into the other in order to check the fit between what we know to be ourselves on the inside and what we see on the outside.

Perhaps at this juncture, it would be valuable to compare the two scoring systems, Holtzman and Lerner, for whatever insight it may afford us in understanding the results. Lerner's scoring system did not distinguish the post-deprivation series of ink blot perceptions from the post-baseline series, while Holtzman's system did. REM deprivation led to increased perception of movement in Holtzman's terms. Although the two systems have much area of overlap, there are two aspects which clearly demark one from the other. Lerner, borrowing heavily from Beck and Klopfer, credits human movement above other kinds, such as animal or inanimate movement, while Holtzman does not make this distinction. On the other hand, Holtzman stresses the degree of movement, tension, or dynamic energy projected into the percept. It is the vitality and aliveness of the percept rather than the question

of human, animal, or inanimate movement that takes precedence. Lerner, following Rorschach, quite correctly stipulates that the percept must be a felt response. Although Holtzman does not specifically single this aspect out, it is highly unlikely that an elaborated perception, indicating dynamic interrelated forces, could be given without an accompanying inner kinesthetic experience. Thus, it seems evident that with regard to the quality of feeling oneself into the given response, the two scoring systems are essentially equivalent. They must both tap inner kinesthetic sensation. Holtzman's scoring, by virtue of accounting for the vitality and dynamic tensions in the projected percept, may also be making some quantitative statement about the intensity of the kinesthetic sensation at the source, the subject's inner experience. The question of human, animal, or inanimate movement, which for workers, such as Klopfer (1954) and Piowtrowski (1957) represent qualitatively different facets of the personality structure, may, in fact, be dealing only with the degree of tolerance that the S has for the percept. Since the perception remains largely a product of the S's own projection, it may be connected with impulses or ideas that are not tolerable in consciousness. We may expect that a percept which is of a human figure in action stems from a core which is less defended against than a percept of an animal or inanimate object, the latter two being related to putting more distance between the projection and the self.

Irrespective of the choice of animal, inanimate or human form, the impetus remains the dynamic interplay of kinesthetic experience within. In fact, projection in its broader sense includes more than the unconscious displacement of unacceptable impulses from the self onto the other. Schachtel (1950) points out that projection is a natural process which may encompass the full range of human emotions. At one end of a continuum of projection is empathy, the ability to experience in oneself the imagined experience in the other. Projection in this sense must always involve identification and may include attitudes, feelings, and strivings which are harmonious with the self concept. These relatively ego-syntonic projections may be the ones that give rise to the common Rorschach hypothesis that human movement in a record is involved with the individual's capacity for creative experience, for the fact of projection into human forms indicates closeness to awareness and acceptability to the self. The more ego-dystonic perceptions would certainly not be available for creative experience, and probably would be candidates for repression.

Lerner's scoring system is on a three point (0, 1, or 2) scale with human movement scored 2, while clear animal movement is generally scored 1. Holtzman's scoring system is on a five point (0, 1, 2, 3, or 4) scale. Human, animal, or inanimate movement may score as high as 4 depending upon the investiture of energy. The Holtzman system attempts to

discriminate more finely and apparently, from the results of this study, can do this in a meaningful way. Some examples from the protocols of the study are illustrative:
"Two beautiful women playing a harp" scored 2 by Lerner's system and 2 by Holtzman. But:
"Someone running into a very strong wind" is scored 2 for Lerner, but 3 for Holtzman. Or:

> "Explosion in a mud volcano. Mud part comes from the cold brown. The very center is mostly clear as if the force were in the center pushing the brown parts apart."

is scored 4 by Holtzman, but only 2 by Lerner. And:
"Two aphids eating on a leafy vegetable" is scored 1 for Lerner, but 2 for Holtzman.

The fact that Holtzman's scoring system differentiates the baseline and deprivation conditions thus has a two-fold significance, the first related to the hypothesis of the study, but the second to the validity of the scoring system and its potential usefulness in clinical applications. A study by Singer, Meltzoff, and Goldman (1952) demonstrated that Rorschach M responses increased following a short period during which time the S was asked to remain in an immobilized position. The relationship of the immobility to the subsequent projection onto the ink blots probably represents a complex process. It is to be noted that a second aspect of this study, in which there was a period of hyperactivity,

did not correspondingly affect M responding. The first condition was likely to arouse primitive layers in the personality while the second was not. It is well known that restriction of motility arouses anxiety or concern in the infant. Activity, on the other hand, is a way of reducing anxiety, and severely disturbed children may become hyperactive as a means of handling their internal conflicts. "Acting-out" is recognized as one method of dealing with the tensions raised by inner psychological conflict. An individual must reach some homeostatic balance between the tensions in his musculature and the characteristic motor innervation pattern, however subtle. Restriction of motility upsets the balance, changes the kinesthetic pattern, and opens up the individual to sensations which he may project onto the world around him. Similarly, REM deprivation leads to projections of a kinesthetically more dynamic nature. The change in the degree of intensity of the projected imagery onto the ink blots between baseline and REM deprivation thus bears on the question of how REM sleep might affect waking function. Following the analysis given above, we would see the post-deprivation individual as representing a changed system of kinesthetic patterns from what he would be following baseline sleep. In this regard a finding of Singer and Spohn (1952, cited from Singer, 1956) was that subjects, whose M responses were rated as relatively more active, were capable of greater motor inhibition and showed less spontaneous motor activity than those

that produced relatively static M. This finding is an indication that activity in the percept does represent observable trait differences in the subjects. We may also then hypothesize that the changed Holtzman scores represent at least a temporary change in the dynamics of our subjects.

B. PATHOGNOMIC VERBALIZATION

The hypothesis relating to REMdeprivation and baseline movement responses discussed above related only to change, but not to the quality of the change. However, there has been much speculation about the potential psychopathological consequences of interfering with the processes of REM. Usually, the REM dream has been considered the important protector of the psyche. This kind of speculation began with the original work of Dement (1960) and is strongly supported by Fisher (1965), but is challenged by Vogel (1968). Greenberg et al.(1970), Clemes and Dement (1967), and Lerner (1966) each demonstrated some increase of pathological indicators following REM deprivation. The results relative to the particular psychopathological indicator selected for this study yields equivocal results over all. The hypothesis that pathognomic verbalization would increase following REM deprivation narrowly misses significance, but it is interesting that when the subjects are divided along relatively field dependent and relatively field independent lines, a significant difference emerges between the groups with respect to the increase of pathognomic verbalization in the two con-

ditions. That the relatively field independent group shows the significantly larger increase is directly opposite to the original hypothesis. Why this should be so certainly needs to be analyzed and understood, but the fact of the significant difference itself is an important finding. It appears that at least for the field independent subject, the effect of 3 consecutive nights of REM sleep reduction leads to the production of test responses that contain more pathognomic indicators than following baseline nights. That this should be so lends weight to the thesis that REM sleep subserves some psychological function, at least for persons with a particular cognitive style.

At this point it becomes evident that in order to fully understand the results, a change in experimental design would have been helpful. The field independent group fell into the extreme range, while the total sample does not include subjects in the extreme range of field dependence. Thus, there is no way of separating a phenomenon that might belong to the extremes from one which is dichotomized by this study. Had subjects been chosen by their field dependent characteristics, clearer distinctions could have emerged. In any future study of this sort, it would be important to represent groups at either extreme and in the middle range. Witkin (1965) points out that the tendency toward psychopathological states is more pronounced at either extreme of the

field dependent spectrum and is less likely in the center range. In effect, this study may be said to contrast an extreme field independent group from a middle group rather than a field independent and a field dependent group. The relative change in pathognomic verbalization of the field independent group is consistently in the direction of an increase from baseline to deprivation conditions for each S. On the other hand, the Ss labelled field dependent in this study show considerable variability. Some show no change, while for some the baseline score exceeds the deprivation score and for others the reverse is true. This great variability suggests that for at least these subjects, there are factors other than the state of REM-deprivation which affect the pathognomic verbalizations of the S, and these unknown factors take precedence. These uncontrolled and unknown factors may relate to the experimental procedures, or could relate to factors which affected the S outside of the experimental laboratory. Indeed, these Ss were instructed as to what to avoid between laboratory sessions, but in essence, they were not prohibited from carrying on their daily activities. It is clear that for the Ss labelled field dependent in this study, REM deprivation did not control the pathognomic verbalization score. For the extreme field independent group, the situation is otherwise; they appear to succumb to more autistic needs and be more driven by inner pressures and be less controlled by the forms of external reality following

REM deprivation. While the study set about to contrast the relative effects of field dependence and field independence, it has only shown that an extreme field independent group changes in the direction of greater pathognomic verbalization following REM deprivation. The relative effects of field dependence-independence must wait for a study which makes a better selection of the Ss involved.

A qualitative review of the protocol of one S who was both among the most field independent and whose pathognomic verbalization score showed among the largest increases from baseline to deprivation is interesting to examine. The conflictual areas for this individual are evident in both protocols, but the loss of controls and the resulting emergence of more clear indicators of the anxiety areas is dramatic. In his baseline protocol, he gives many indicators of homosexual longings which appear to have underlying a fantasy of the ungiving breast and the dangerous and destructive nature of the vagina. He starts his baseline protocol with 2 defining responses, "Looks like a pelvis. I don't know anatomy that well," and "These sort of look like breasts with the split and the nipple." In spite of the implication, the responses remain controlled. Later in the protocol, the relation to the vagina is clearly shown by a sequence analysis,

> "Down here in the center is an
> Oriental picture of a woman.
> She has a small head, thick arms,
> very, very thin buttocks and thighs."

followed quickly by,

> "A grizzly mouth - broken teeth - everything. It looks awful. No lips, they are very, very thin lips."

again followed by,

> "Here we've got another woman's genitals. Cross section of it here with all kinds of extraneous flesh."

Other responses in the protocol accent this anxiety theme. In particular, there are references to mouths and lips. The deprivation protocol deals with these same conflictual areas, but the degree of control is much reduced, and there is more blatant emergence of the anxiety area. A few quotes will suffice to show the change,

> "... it's a religious picture with God up here blessing the cold Hell, and this hole here is the bowels of Hell."

and

> "... this things here is a guy's face - this is his lips. Now what he's kissing here might be a woman's breast whose nipples have been amputated."

and

> "I think I am going to see a vagina. This is a woman's genitalia. This slightly white space, line is the vagina and these are labia majora."

and

> "... they could almost be nuns. They've got large penises and they're taking a shit ... "

The themes of the dangerous vagina, "the bowels of hell," and the unsuccessful attempt to stave off a percept of the vagina are clearly seen. When he says, "I think I am going to see a vagina," he is obviously becoming aware of the impulse, but is unable to stop the emergence of the drive related material. The ungiving breast is blatantly obvious in the amputated nipples and the homosexual orientation in the "nuns with large penises." While the material shows a great deal of correspondence in terms of the kinds of content in the two records, the deprivation protocol is less disguised. This kind of result is in line with the work of Greenberg et al. (1970) who similarly show that post-deprivation projective protocols show freer expression of areas defended against in baseline and control testing.

C. TASK IRRELEVANT FANTASY

The hypothesis related to the subject's waking fantasy postulated that REM deprivation would lead to an increase in fantasy unrelated to the cognitive, discriminative task engaged in. The implied model is that REM deprivation is associated with dream deprivation, and a process similar to dreaming would intrude itself upon the subject in order to "make up" for the dream fantasy that was curtailed. It would look like the increase in "REM pressure" that develops as REM deprivation procedures continue. The interruption of REM sleep usually leads to increased attempts on the part of the S to enter this phase of sleep, shorter latency periods

from sleep onset to first REM period, and "rebound" effects when sleep is left undisturbed. In effect, the "REM pressure" it was felt might emerge as insistent intrusive fantasy substituting for the loss of the cognitive content of REM. Fiss, Bokert, and Klein (1966) showed that TAT stories from subjects awakened following a period of REM sleep showed more bizarre and intrusive thoughts , more vivid imagery, and more intense affect than TAT stories that were produced in an awakening subsequent to non-REM sleep. It seemed as if REM was productive of pressures to produce fantasy of a dream-like nature and that this pressure continued for a short period after REM completion. It is not surprising to see a residual since one does not expect an aroused state to end precipitously. One would then wonder if REM were curtailed, as in this study, if the activation demonstrated by Fiss et al., would not become a cumulative pressure building up over the curtailment of many REM periods and becoming manifest in intrusive waking fantasy.

The results do not support this implied, if not directly stated, relationship between REM and waking fantasy. The amount of intrusive fantasy experienced by the S, in fact, decreased rather than increased following the three nights of REM deprivation, albeit not significantly so. However, the p value was suggestive, and the decrease was persistent at each of the three rates of signal detection giving a suggestion of a real effect. An interesting study

by Fiss, Ellman, and Klein (1969) may relate to the failure to demonstrate the hypothesis as originally stated. Using essentially the same TAT technique employed by Fiss, et al. (1966), they elicited stories from Ss in three conditions. In one condition, the S was awakened early in the REM period, a situation approaching the definition of REM deprivation as used in this study; in the second, the S was awakened after REM completion; while in the third, the S's awakening was arranged to interrupt an ongoing REM period. It was this latter group that showed the greatest "carry over" effect. The results obtained by Fiss, et al. (1966) are not compatible with a hypothesis of an independent pressure for a certain kind of mentation which might intrude into waking experience. If this were the case, then the early awakening would have led to the greatest carry over effect. The rejection of the task irrelevant fantasy hypothesis as originally stated and the suggestive opposite result, tends to diminish the validity of the model for REM that gave rise to the original hypothesis. It is to be noted that Fisher (1965) also suggested that REM deprivation, if carried on far enough, would lead to the irruptionof the dream into wakefulness. This notion is clearly not supported. We are left rather with a result which indicates that REM deprivation leads to a diminishing of attention to, or production of, intrusive fantasy.

An individual engaged in a cognitive task may be

thought of as having two components of attention, one directed to thetask and a second which is related to a less voluntary inner fantasy. The splitting of attention into these two components occurs even under high task demand. Singer (1966) comments on the persistence of the inner component in describing the results of experiments using the same essential technique:

> "... one of the most dramatic finding of the experiment (Antrobus and Singer, 1964) was the magnitude of fantasies, daydreams, or reminiscences which were reported. It is indeed remarkable that a person can listen to tones presented at the rate of one per second, judge whether each is the same or different from the pitch of a preceding signal, indicate his judgement on a hand switch, ... and at the same time imagine a summer holiday or plan his next date with his girl friend." (p 114)

Singer (1966) indicates that using this technique of tapping the spontaneous fantasy, the intrusive task unrelated cognition is reduced as the external demand increases, although, as indicated above, is not eliminated. REM deprivation appears to affect the process in the same way as increasing the task difficulty. Within the limits of the experimental design, the accuracy of performance of the task did not deteriorate, but the production of spontaneous fantasy lessened. Two possibilities immediately present themselves concerning the underlying process. The first would be that the REM deprivation experience acts directly on the ability of the S to turn his attention to, or produce, spontaneous fan-

tasy. REM may be seen as an activation process which is carried into the waking state. The absence of REM would then mean the absence of activation and thus the curtailment of spontaneously produced fantasy. In the second instance, we might think of a reciprocal relationship existing between the attention usurped by the task, and the residual turned toward inner fantasy. REM would then be seen as the disrupter of one's ability to perform a cognitive task, but by withdrawing cathexis from the inner process, additional resources would become available to maintain task performance at a stable level. Reasoned speculation from the data of this study would seem to rule out both possibilities. We find that the spontaneous fantasy is reduced primarily in the medium difficulty situation, while there is relatively little change in either the difficult or very easy of accomplishment condition. This second model would call for the greatest effects in the most difficult task condition. On the other hand, the near significant level only at the medium difficulty of the task. In fact, at the medium difficulty, a significant correlation develops between the S's self rating on the I-frequency and the deprivation minus baseline spontaneous fantasy score. A best fit of the data is probably made if the individual is considered to harbor at all times a continous stream of mentation perhaps related to information processing of all kinds. Singer (1971) presents this

point of view with considerable amounts of supporting evidence. This continuous stream of cognitive processing may go on out of one's awareness and may become available under certain conditions and be modulated according to stylistic tendencies. Singer (1971) makes this point:

> "there is considerable support for the idea that individuals differ markedly in their styles of self-awareness, imagery availability, interest in or capacity to report fantasy, freedom from dependence on the stimulation of the environment so as to look 'inward', and fear or suspicion of internally-generated material." (p 85)

If we now assume that among the processing needs of the individual are not only cognitively neutral material, but many kinds of conflictual material as well, it would not be surprising that one's characteristic style would come to the fore. For some, examination of the ongoing stream would represent a method of coming to grips with new signals, while for some, it would precipitate a retreat, perhaps a phenomenon which bears the characteristics of perceptual defense. In this study, the Ss were in fact asked whether or not they ordinarily paid attention to fantasy processes, and they may have been able to report this with some degree of accuracy. They were, in effect, telling us where they stood on a continuum of a dimension that relates quantity of attention to internally generated fantasy products. However, the situation is somewhat more complicated in that differences disappear when the task difficulty is too easy or too difficult.

We must include something akin to a tuning function, that is, the entire process may become submerged when the conditions are not within defined limits. Again, Singer (1971), in relation to training individuals to pay attention to inner fantasy, stresses the need for a conductive situation. The reduction of external stimuli is considered important. This is well met by the darkened sound attenuated chamber employed for this portion of the experiment. The task of medium difficulty which was performed well may be the equivalent of a continuous monotonous task which is known to stimulate fantasy perception. The difficult condition may have taken too much of the S's attention, while the too easy condition may have allowed too much time for processing and forgetting.

It is tempting to relate the results of the TIF portion of this study to what might at first seem like an unrelated study by Vogel, et al. (1968). They REM deprived five psychotically depressed patients over periods of from 7 to 14 consecutive nights and noted that in the patients, where consistent REM pressure developed, there was marked clinical improvement as measured by subjective and objective criteria. In subjects where REM pressure did not build, they saw no clinical improvement, while in one subject where REM pressure began late and did not show consistent rise, there was partial improvement.

It is well known that the psychotically depressed patient is self-accusatory, that typically he heaps blame upon himself for having committed the most heinous of crimes, and often states that the world and his family would be better off without him. Using the structural language of psychoanalytic thought, he may be thought of as super-ego dominated, that the self-accusations derive from this agency of the mind. The psychotically depressed patient may be thought of as being attacked in inner fantasy by a persecutory imago. We may speculate that the same confrontation occurs during REM dreams, as well as in waking fantasy. Hence, the depressed patient tends to rise early, perhaps to escape the dream images, but then to find himself facing the same attacks arising from the ongoing stream of consciousness. REM deprivation may then act to reduce the fantasy attack during the REM dream, providing relief for the patient and a chance to re-establish defenses that have worked in the past. However, if REM deprivation was followed by increased pressure to make contact with waking fantasy, we would expect little help for the patient, but our TIF data indicates that this is not the case. For many Ss, REM deprivation is followed by a corresponding decrease in TIF. We may speculate that the LI Ss, who show the decrease in TIF following REM deprivation, would be the ones who could benefit from REM deprivation for the treatment of depression. Depression, according to this view, is seen as a psychically determined phen-

omen, and anti-depressant medication may be thought of as working through the suppression of REM. Vogel, et al. (1968) point out that the major chemical anti-depressants are also REM deprivers. The marginal significance attained in and of itself stresses the need for replication, but within the realm of reasonable speculation, it appears that the REM deprivation condition gives rise to a temporary dynamic change in the individual. For some subjects, this means greater attention to an ongoing inner process, while for others, it means retreat from this inner stream. However, only to the extent that we can optimize the conditions are we able to tap into and recover the data which signifies the ongoing process.

CHAPTER V

FURTHER DISCUSSION AND IMPLICATIONS

A number of theoretical approaches have been espoused in order to make sense of and give meaning to the many observable phenomena associated with REM. This is as it should be, since only in this way is it possible to try out the empirical evidence as it comes upon the scene, while at the same time obtaining direction for future research energies which may enrich our knowledge. It is not surprising that, as the REM phenomena became the subject of extensive investigations in the early 1960's, classical drive theory was immediately pressed into service. The dramatic finding of REM compensation seemed to fit the idea of the REM dream being a substitute discharge mechanism. The prominence of drive theory in psychology, as well as its role in shaping the hypotheses of this study, insists that the data be evaluated in its light.

The increase in the Holtzman movement score is compatible with the discharge hypothesis in that it may be seen as an attempt to deal with heightened tension through projection. Perhaps this kind of defense could be seen at a heightened level in other aspects of the S's behavior.

The near significant result on the pathognomic verbalization variable could again be seen in terms of this theory, since unresolved conflict would be expected to increase id pressures for discharge with a subsequent warping of perceptions in an autistic direction. Why this should occur to a significant degree when field independent Ss are compared to Ss in the mid range of this dimension would be more difficult for this theory to tackle. The results of the task unrelated fantasy portion of this study are opposite to what the theory would predict. Of course, we are dealing with a marginal result and again a stylistic difference becomes a prominent feature, that is, the HI and LI Ss differ in their responses. Drive discharge theory would certainly predict that the maximum task irrelevant fantasy change would occur in the low demand condition. One would expect that in a quiet darkened room with little movement possible and with little investiture in the task, that an S would be, in effect, a "sitting duck" for a shot gun blast from the id. In fact, this did not develop; the overall trend was for a reduction in fantasy, and in any event, this was primarily a function of the medium demand situation. One is thus hard put to see the overall results as especially supportive of the discharge hypothesis of REM sleep.

Although the results of the study have not produced strong results, what is most reasonable to take from it is

that REM processes do not have monolithic effects, but are more probably related to the characteristic styles of the Ss. In this regard, the work of Cartwright and her co-workers and Greenberg, et al. are supported. On the other hand, the methodology adapted from Singer and Antrobus (1966) appears to be a promising approach to fully understanding the effects of REM and it's negative, namely, REM deprivation. In this study, the Ss were heavily taxed by the demands of the host study, and indeed this could, in and of itself, tend to diminish the significance of results. However, this precluded a more complete application of the task irrelevant fantasy technique. Singer's (1971) idea of the continuous stream of unconscious processing of cognitive products makes a technique of this kind extremely valuable. The application of projective techniques may have served the function of stressing that some phenomenal change has taken place when REM deprivation techniques are applied, but the TIF technique has the advantage of microscopically attempting to catch the events in process. Of course, in this study, only the quantity of fantasy was collected, but it seems entirely possible to move into the sleeping chamber for a new kind of marriage similar to the approach of Fiss and his co-workers. They have gone to the S with TAT materials immediately during, or immediately subsequent to, the occurrence of REM. The TIF technique is suitable in the same way, the S working directly from his bed. However, there would need to be

much greater emphasis on collecting the actual fantasy. Recognizing that certain conditions improve the conduciveness of the S to report and these being subject to experimental manipulation, it is entirely possible that a new world may be discovered either during REM or non-REM sleep. It is almost needless to mention that ideally no study should be so loaded with unrelated tasks. The contamination of results by the Stage II mentation reports and the reporting of dreams through dream logs and morning reports are impossible to disentangle from the experimental results. Perhaps it is to be wondered at that any systematic results were possible with so large an amount of contamination.

A. SUMMARY

Nineteen subjects taking part in a REM deprivation experiment, being conducted at the City College of New York by Arkin and Antrobus, responded to Holtzman ink blot plates in a manner similar to standard Rorschach administrations, with the exception of a drastically curtailed inquiry, and performed an auditory discrimination task while keeping track of their spontaneously generated task irrelevant fantasy. The subjects were REM deprived for three consecutive nights by being awakened each time that rapid eye movements were evidenced during REM sleep. After three nights at home, they returned to the laboratory for three baseline nights in which REM sleep was left undisturbed,

but awakenings to match the first three laboratory nights were made distributed through Stage II sleep. Mentation reports were obtained from Stage II for the purposes of the host study on all laboratory nights.

It was predicted that there would be increases in movement responses to the ink blot plates, that pathognomic verbalizations would increase, and that task irrelevant fantasy would increase when the deprivation scores were compared to the baseline scores. In addition, the subjects were evaluated as to their relative positions on a field dependence rod and frame test, and they rated themselves as to the amount of day and night dream fantasy they ordinarily experienced in their daily lives. It was felt that the movement, pathognomic verbalization, and task irrelevant fantasy score increases would be greatest for the field dependent and the persons who reported less experience of day and night dream fantasy.

The hypothesis for the increase of movement responses proved significant, but only when the scoring was done according to the Holtzman technique. Scoring according to a proposal of Lerner (1966), following more classical lines, did not differentiate. Increases in pathognomic verbalizations were suggestively close, but did not reach significance. However, when an extreme field independent group was separated, the increase was significant. This was opposite to the hypothesis put forward, and it was explained

on the basis of the distribution of the scores on this dimension. An extreme field dependent group did not develop, and it was noted that the tendency toward pathology was more pronounced at either extreme of the dimension. The results for the task irrelevant fantasy overall was a decrease rather than an increase as expected, although the decrease was again suggestively close, but did not reach significance. When Ss, high in day and night dream frequency, were compared to SS who report less such experience, it was found that they responded in opposite direction, that is, the highs increasing their task irrelevant fantasy, while the lows decreased their scores on this measure. The difference was a near significant result. However, it was noticed that almost the entire difference came about when the Ss performed the medium difficulty task. When the task irrelevant fantasy scores were singled out for this medium difficulty task, a significant positive correlation was noted between the S's self ranking on the day-night dream experience and the increase in task irrelevant fantasy under the conditions of the experiment.

While several aspects of the study could be derived from classical ideas about dreams being substitute discharge mechanisms, all aspects of the study would not support this view. It does seem, however, that REM deprivation does have effects on the individual in his waking state, but that these effects are modulated by stylistic tendencies and are not uniform across all subjects. It was suggested that task

irrelevant fantasy methodology utilized for the purposes of this experiment could be employed to more directly tap sleep events immediately following a target sleep phase.

APPENDIX A

PROCEDURE FOR PORTABLE RFT - ADULTS

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Note: Apparatus must be on sturdy table and be level.

Before seating S in front of apparatus:

"In this test we want to find out how well you can determine the upright - the vertical - under various conditions."

"In this box (PRFT), you will see a square frame and within this frame you will see a rod."

"It is possible for me to tilt the frame to the left or the right. I can also tilt the rod to the left or right. I can tilt the frame alone or the rod alone; or I can tilt them both at the same time, either to the same side or to opposite sides."

"When I lower the curtain at the beginning of each trial, I want you to tell me whether the rod and frame are straight up and down - i.e., vertical - or whether they are tilted. In other words, tell me whether the rod and frame are straight with the walls of this room or whether they are tilted."

"Are there any questions?"

Seat S in front of apparatus and adjust head rest. S's hands must be in his lap, not touching table. Tell S to keep his head in the rest at all times.

Trial 1: Adjust the frame to 28L and the rod to 28L. Lower curtain. Say to S: "What is the position of the rod and the frame?" (Record S's response.)

If S says the rod is not vertical, say to him:

> "I will now turn the rod slowly until you think it is straight with the walls of this room. As I said, I will turn it slowly, and after each turn, tell me whether it has been turned enough or whether you want it turned some more. Just say

'more' or 'enough' after each turn. Please make your decisions quickly and don't be too finicky. Which way shall I move the rod to make it vertical - clock wise or counterclockwise?"

Now move the rod about 3^{o} at a time opposite to the direction in which the S says it is tilted, until he reports "enough." Ask the S after he reports the rod vertical: "Is the rod now vertical - that is, is it straight with the walls of this room? In other words, is it straight up the way the flagpole outside is?"

If the S should now say that he wants the rod moved some more in either direction, do so. Raise the curtain and record the position of the rod.

If on this first trial, the S reports the rod to be straight at the outset, ask him the question: "Is the rod now vertical, that is, is it straight with the walls of this room?"

In such instances, give the S the instructions concerning the straightening of the rod, as above, on the next trial. If on the next trial, the S again states that the rod is straight at the outset, give him these instructions on the first trial on which he says that the rod is tilted.

Trial 2: Leave the frame at 28L and adjust the rod to 28R. Lower the curtain and say to the S:

"Would you tell me now and at the beginning of all subsequent trials whether the rod and frame are straight with the walls of this room, or tilted; and if the rod is tilted, whether the ros should be moved clockwise or counterclockwise to be made straight."

If the S asks you to turn the rod, do so until he says "enough."

Ask him again: "Is the rod now vertical - that is, is it straight with the walls of this room?"

Do not ask this question on subsequent trials. Raise curtain. Record adjustment. Proceed to the next trials.

Trial 3: Frame 28R Rod 28R

Trial 4: Fname 28R Rod 28L

Trial 5: Frame 28L Rod 28L

Trial 6: Frame 28L Rod 28R

Trial 7: Frame 28R Rod 28R

Trial 8: Frame 28R Rod 28L

Before S enters the room, be sure frame is straight and curtain up.

If at any time after the rod has been adjusted on a given trial, the S should say that he wants it moved some more in either direction, do so.

If the S should take more than 5 seconds on any trial before saying "more" or "enough", tell him: "Please make your decisions quickly."

If the S should repeatedly say "more" or "enough" before the turn of the rod is completed, say to him: "Please wait until I have completed the turn."

Check from time to time to determine whether the S's head is in the proper position in the head rest. Attaching the elastic cord around the back of S's head is recommended.

APPENDIX B

SCORING EXAMPLES FOR PATHOGNOMIC VERBALIZATION

FABULATION (FB)

Score 1

16A--A kind monster--eyes, and he looks real sweet. (W)

35A--Sinister insect or underwater ray--sinister eyes, blunt stinger. (W)

37A--Two old gossipy women, (d_1)

2B--A frog, sort of a stupid frog. Really happy--you know, sort of dumb, easygoing. (W)

7B--A person who is very discouraged. He is really sad. (d_4)

12B--Halloween--cats are screaming. (d_3)

19B--Two hermits in a cave playing musical instruments, people sitting around admiring talents of two men--two creatures up here laughing at them. (W)

26B--Two elephants looking at each other--one happy, one sad. (W)

27B--Two sea horses--pompous. Staring at each other--will not give ground. (W)

27B--Two lions --marching away harmoniously. (D_1)

36B--Kind of frightening--avicious spider. (W)

FABULIZED COMBINATION (FC)

Score 2

10A--Two people and it's strange--they have tails, playing a childish game of patty cake. (D_1)

16A--Two Indian heads. A swirl of flame around it. (D_1)

21A--Wild animals fleeing--seldom see ducks on top of deer's antlers. Ducks (d_1), deer (d_3). (W)

34A--Two men carrying a wishbone. (W)

8B--A black bed of rock (d_3) at the edge of a mountain peak (d_1), with a tree on top of the mountain that's on fire. (D_1)

14B--Sheep's head on a human. (D_1)

16B--Whiskey bottle (D_2) with two dogs chasing around it (d_2).

32B--Two roosters (d_1) fighting over a pulley bone--breast of a chicken. (W)

Score 3

14A--The human body--creatures on each side "pesting" it. Body (D_2), creatures (D_1).

14A--Fluoroscope picture of a giant with two doctors on each side, looking and pointing. Red part is cancer. (W)

20A--Might be a squirrel climbing up a tree. A horse kicking a squirrel out of a tree. Horse is up in tree--chestnuts (d_1), squirrel (D_1).

7B--Human face (d_4s) breathing fire out two sides of mouth (d_3).

14B--Some kind of get-together. Two caterpillars (D_2) talking to each other in a sociable mood, don't seem to mind having the sheep (D_1) around.

14B--Two foreign dancers (D_1) fighting over some meat (d_2) ordancing around it. Looks like bacon.

17B--Couple of hens sitting on nest, talking about two little red eggs (d_3). (upper half, blot inverted)

31B--Two witches lying on some sort of lobster. She's lying on top of lobster, face down. (D_1)

32B--Two women with feathers. They look like they have old time phonograph horns for heads. (d_3)

32B--Female species, prehistoric monster doing a little dancing, celebrating. They're doing a little dance--possibly a mambo of some kind. (W)

44B--Two insects on fire. They're laying by four stakes drove in the ground. (W)

Score 4

21A--A king in a pack of cards. All others are attached to the king, like by fingers. (whole right side)

34A--A couple of people (D_1)--very black. Fish (d_2) coming out of them.

16B--Two poodles (d_1) resting against a rocket ship (D_2) and these people (d_2) look like they are giving up and walking off. The poodles seem very nonchalant. Looks like one is holding a flower; the other has a cigarette.

16B--Looks like a cucumber--but it's alive, leaning up against a bottle of wine--each cucumber thing (d_1) has a carnation in its hand, very pleased with himself, leaning on bottle for support. (D_2)

18B--A round ocean split in middle and opened up with two little girls facing each other. A tube is connected from the forehead of one girl to the ocean. (W)

41B--Fire all around, little heads looking at each other out of separate pots of fire--two little men floating in air, got legs about to kick other one. Big ones have noses, others just round heads. (W)

45B--The flying skeleton of an animal. He's got feet and toes like a chicken (d_1) with two long front teeth in the skull (d_3). He is flying over a highway with cars in it and a swimming hole right here (D_2).

QUEER RESPONSE (QR)

Score 1

5A--A pattern for testing eyes--it's a counterbalance of colors--black and white. (W)

30A--Chinese drawing of a Chinese house, done by a Chinaman. (W)

32A--X-ray picture of big bird. Can see bones and where wings hook on. (W)

33A--A blue target for forms of ammunition coming out of the sky. (W)

37A--Insects crawling on their backs. (d_1)

6B--Another feminine distribution. (D_1)

14 --It all seems to point to one road. They're a little bit disturbing at times. (W)

35B--Four cats. I would like for these to be dogs, but the form isn't right--they're really cats. (W)

38B--Goat--thrown out from center. (D_1)

40B--A growth down in the interior of the ocean. (W)

Score 2

7A--Head of an animal with face carved out of it. (W)

13A--Someone laying in the sand--partially covered. Don't see much green sand nowadays. (d_1)

14A--The male part of the back--like the muscles in the biceps formed in the V-shaped web. (D_2)

14A--Skeleton of something trying to get to the top of something. (D_1)

8B--Pinnacle (D_1) residing on a platter (d_1)--sometimes called spiral.

32B--A prehistoric picture of a relic--here's the eye (d_4). (W)

38B--The insides of a bat. (D_1)

Score 3

6A--Cabbage bed--full of cauliflowers and cherries. (W)

6A--Murder and the bodies have been mangled. It's sort of green, bruised, ugly. (W)

10A--Mold (d_5). It has poisoned anything coming into it--black part, then lightness. Looks like it might spread.

4B--A feminine picture. A feminine and a masculine (d_2). The two walls. The valley (d_6s). (W)

12B--Two Indian chiefs having a "pow-wow." One on left possibly won the applause. The headdress seems to be adjusted for hearing. (D_2)

14B--It's masculine--a penis. It's got circular plane around it--aknife blade. (D_2)

17B--Might be rectal saliva--the saliva is on the two sides. (W)

18B--Old underclothing being exchanged for new. It's torn, misplaced, misused and been mangled--kind of a similar effect to it. Front part (D_2) is where she's torn it up. (W)

INCOHERENCE (IC)

Score 4

1A--A crocodile top--a shell fish. Forms the lines of the earth. Something like a V. (W)

3A--Represents a Yatomic--something that most people don't understand. Yatomic is something that man doesn't show to this earth--not often but may stay on for three months when comes--may stay on for two days. An atomic didn't happen in Jay'pan. Was not from plane is Antilatious gas--from controls from U.S. (W)

4A--The sky--in the motion pictures in Lincoln's pictures. Colored crabs in it. Crabs on the wall of the earth. That's history. (W)

12A--A delivery--a shot from the skies--a blast. Sky shooting off the direct top of the sky. (W)

14A--A dental of hell. Under-misunderstanding. (W)

5B--Plot of Ponus Ray. A plot took at 4500 feet took by economical--it is the equator changes every 4500 years--changing this year--over this nation--not in North America, but over South America. (W)

8B--Something is electricity we use every day--is something coated 4,000,005 years and six months ago. Demonstration of volts of bulbs--and what makes electricity--not just from dynamo but also from air. Represents electricity. (W)

20B--A chimpanzee resinol settus. Between set and sad--may not be in dictionary--course our language is not complete. What they said when they built that tower of Babel--the blood color, blood in the veins--it

also says that they have calcium, flours, phosphate, sodium, bones. (W)

21B--(Laughs) A steer--say buffalo. Buffalo color--a bear and a gorilla--their sexual drainage system--horns (d_1). Skeletal and his leather hide (d_5s). Blood and rectum. (D_3S)

22B--Two colors--or three--that would be the masculine. Where have I ever seen that! It's a prison--presentable--that's masculine. (W)

24B--Blood--drains out when a sharp instrument's placed in the id--all men in the flesh--the flow of the blood. The cumulation of the cell or "mestris." (W)

AUTISTIC LOGIC (AL)

Score 1

10A--Men with broken legs. (Qc)--"Cause it isn't connected to the body. (D_1)

15A--Owl. Has ears (d_4) and looks smart. (W)

32A--Two bookend characters (D_1). (Q_c)--been pulled apart --these (d_2) indicate that. (W)

35A--Two bulls, fairy bulls--'cause dressed up in pink. (d_1)

1B--Two dogs--they're from the same litter because they look alike. (D_1)

27B--Looks like it's supposed to have a backbone, but I can't tell what it is (d_3s). (Qc)--there's a place here for a backbone.

32B--A road going up the side of a mountain--ends at the top; there was supposed to be a bridge here, but it's fallen. (D_2)

Score 2

29A--Chair; the back (d_1) here. (W)

33A--Alaska. (Qc)--because it is cold and blue (d_3-igloo). (D_1)

37A--Horse's skeleton; the hoof (d_6) and ribs (d_5). (W)

42A--A breast; the nipples here (d_6). (D_3)

21B--Elephant; trunk (d_1) here. (D_1)

35B--X-ray of a small body--an insect of some kind. (Qc) --couldn't be bones because nothing sticking out-- the shape looks like an insect--something small. (d_6s)

Score 3

2A--A boat; there are anchors (d_4). (W)

10A--A stalactite because it's all by itself. (d_8)

12A--(Apathetic) Must be a deserted lobster--I don't know --doesn't have anything on it. (W)

36A--A robe--scholastic type arms (d_1). Of course, the person hasn't got a head, but that's not necessary if the robe is there. (W)

2B--Represents trimmings of international banks and state fixtures--because not made of wood, but of mineral ore. (W)

22B--A bust of Mussolini (d_1), because the bottom part here looks like the boot of Italy.

33B--Map of U.S.; Florida here (d_6). (D_1, card inverted)

35B--Person beating a dog--has arm raised with club (d_1). (Qc)--Dog seems afraid so it is arm of person. (D_1)

39B--Two toadstools growing up out of trashy-looking mess --that is why they are toadstools. (W)

43B--A very magnified picture of a fly. (Qc)--Fuzzy-- this (d_2) is so large in the picture but it is simple, so it is part of a small bug. Wings (D_1), body and legs, (D_2). (W)

Score 4

43A--A carbon copy of a person because he's lying down on carbon paper. (W)

45A--Two people on two different suns talking to one another. (Qc)--'cause there's space between 'em. (W)

4B--A heart bleeding bile. (Qc)--because it's broken and bitter. (W)

20B--Looks like a map--the map of the world. (Qc)--the little writing (D_1) in here. (W)

21B--Two soldiers studying why Anchorage is always over their heads. See the two anchors (d_4). Pink--because it's in Alaska.

24B--People, bugs, insects falling through outer space. (Qc)--they're on fire, people on fire but no flames. (W)

26B--Picture of a cat crying pink champagne. (Qc)--Tears aren't pink, but pink champagne is--undoubtedly a wealthy cat. (W)

45B--Two hands with claws instead of fingers. (Qc)--Claws because they want to poison one another. (d_1)

CONTAMINATION (CT)

Score 2

10A--A man here, but it also looks like sand. Maybe he lives in the desert. (D_1)

37A--That's a cross between a woman and a bird of some kind. (D_1)

41A--This is a tree--not exactly a tree--a spinal cord, but it could be looked on as a tree. (D_1)

8B--A diamond--uh, no, a man's head. I guess it's a diamond-shaped head. (d_2)

Score 3

3A--Exploded blood. (D_2)

10A--Must be a monkey--a splattered material--that's what it is. (right side)

16A--Face of a sun-man. Yellow, orange, and red suggest intense heat--bluish eyeballs. (W)

22A--Sort of a woman-beast. Greyish hair, hair in face--two jaws (D_1) down here. (W)

42B--There's a bright yellow--a cowardly boxer, a yellow streak down his back. (W)

Score 4

2A--Must be a cricket--a man-cricket. Shaped like crickets and men. (D_1)

20A--A catechism. It's printed like fingerprints. A catechismic-print. (W)

26A--A man; no, a bat--a batman. (d_1)

31A--A book. Like a cover--engine cover--sort of cover of a book which was stamped. (W)

11B--That looks like a stone stain--looks like a heart--well a stained heart. (W)

SELF REFERENCE (SR)

Score 2

26A--Mouth of something. I am inside looking out--have feeling standing back and looking out--it's black all around me--seem to be peering through teeth (d_5) of something. (D_1)

31A--A face. God, I am seeing faces in everything, but I can't help it. (W)

12B--A small animal, trees protecting him; if I was him I wouldn't have to worry about security either. (d_3)

Score 3

2A--A man. I haven't got the strength to tell him what to do. He can't decide because he is old. (D_1)

44B--A butterfly; God told me what it was in my dream last night. (W)

20B--I think that is an old girl friend of mine. Just put her name down: P_____F_____B_____ (W)

27B-- A chimp's rectal. I don't know where they got that picture. I don't look like that--or maybe I do. (W)

Score 4

18A--That's part of a person's forehead--inside of a person's forehead. Brainwash. I've had my forehead come off and it appears the same. (W)

23A--That's my gall bladder before the operation, when the enemy was after me. (W)

14B--That's probably me--trying to picture a slant. If I don't, there won't be anymore. I might be a god. (W)

29B--A person's face. Looks like my face; maybe I lost it. (W)

DETERIORATION COLOR (DC)

Score 2

13A--A green sky. (W)

15A--A circular reaction of the body. All the various colors are inside the body in this particular stage of life. (W)

16B--Part of the body, inside, red and bloody. (W)

28B--A cherry because it's red. (W)

Score 3

6A--A mass of entrails. The nice nauseating colors--white, pink, green brown, black. (d_2)

20A--Purple bones--diseased. Black disfigured bones. (W)

42A--Pelvis, unborn. Yellow is dormant--red for living blood. (W)

6B--X-ray of person--shows the inside movements--black disease eating away at healthy tissue. (D_1)

20B--Could be an infection, being treated by some purple serum. (W)

Score 4

27A--That's a sky--a black sky, a yellow sky, and a blue sky--black, yellow, blue, white, all kinds of white. (W)

39A--Color--the color is orange and orange and light orange and pink--millions of colors--1000 million colors. (W)

4B--The yellow is a virulent disease, the yellow plague--the kiss of death. (d_6 and surrounding yellow)

17B--These dark colors are evil, but the bright colors are trying to remedy it. (W)

42B--Yellow blood pouring over red blood, slowly trying to surround it. (W)

ABSURD RESPONSE (AB)

Score 3

7A--That could be a hippopotamus spread out like that. (W)

18A--A praying mantis praying. (W)

32A--King Tut's tomb, a pyramid. (W)

36A--The Empire State Building. (W)

43A--A male sexual organ. (W)

15B--That's a baby, and this is the umbilical cord (d_1). (W)

23B--A map of the United States showing the different states. (W)

37B--That isn't a shoelace, is it? (W)

38B--A cat, the head--these are the eyes (d_2). (W)

39B--The knee of the human body. (W)

REFERENCES

Antrobus, J.S., Singer, J.L., and Greenberg, S. Studies in the stream of consciousness: Experimental enhancement and suppression of spontaneous cognitive processes. Perceptual and Motor Skills, 1966, 23, 399-417.

Aserinsky, E. and Kleitman, N. Regularly occuring periods of eye motility and concomitant phenomena during sleep. Science, 1953, 118, 273.

Cartwright, R.D. Dream and drug-induced fantasy behavior. Archives of General Psychiatry, 1966, 15, 7-15.

Cartwright, R.D. and Monroe, L.J. Relation of dreaming and REM sleep; The effects of REM deprivation under two conditions. Journal of Personality and Social Psychology, 1968, 10, 69-74.

Cartwright, R.D., Monroe, L.J., and Palmer, C. Individual differences in response to REM deprivation. Archives of General Psychiatry, 1967, 16, 297-303.

Clemes, R.S. and Dement, W.C. Effect of REM sleep deprivation on psychological functioning. The Journal of Nervous and Mental Disease, 1967, 144, No. 6, 485-491.

Dement, W.C. and Kleitman, N. Cyclic variations in the EEG during sleep and their relation to eye movements, body motility and dreaming. Electroencephalography and Clinical Neurophysiology, 1957, 9, 673-690.

Dement, W.C. and Kleitman, N. The relation of eye movements during sleep to dream activity: An objective method for the study of dreaming. Journal of Experimental Psychology, 1957, 53, 339-346.

Dement, W.C. The effects of dream deprivation. Science, 1960, 131, 1705-1707.

Dement, W.C., Greenberg, S., and Klein, R. The effect of partial REM sleep deprivation and delayed recovery. Journal of Psychiatric Research, 1966, 4, 141-152.

Elliot, P. Interrelationships among measures of field dependence, ability, and traits. Journal of Abnormal Soc. Psychology, 1961, 63, 26-36.

Fischer, C. Psychoanalytic implications of recent research on sleep and dreaming: I. Empirical findings; II. Implications for psychoanalytic theory. Journal of the American Psychoanalytic Association, 1965, 13, No. 2, 197-303.

Fisher, C. and Dement, W.C. Studies on the psychopathology of sleep and dreams. American Journal of Psychiatry, 1963, 119, 1160-1168.

Fiss, H., Ellman, S.J., and Klein, G.S. Waking fantasies following interrupted and completed REM periods. Archives of General Psychiatry, 1969, 21, 230-239.

Fiss, H., Klein, G.S., and Bokert, E. Waking fantasies following interruption of two types of sleep. Archives of General Psychiatry, 1966, 14, 543-551.

Foulkes, W.D. Dream reports from different states of sleep. Journal of Abnormal and Social Psychology, 1962, 65, 14-25.

Greenberg, R., Pearlman, C., Fingar, R., Kantrowitz, J., and Kawliche, S. The effects of dream deprivation: Implications for a theory of the psychological function of dreaming. British Journal of Medical Psychology, 1970, 43, No. I, 1-11.

Holtzman, W.H., Thorpe, J.S., Swartz, J.D., and Herron, E.W. Inkblot perception and personality. Austin, Texas: University of Texas Press, 1961.

Kales, A., Hoedemaker, F., Jacobson, A., and Lichtenstein, E. Dream deprivation: An experimental reappraisal. Nature, 1964, 204, 1337-1338.

Kibie, L.S. The concept of dream deprivation: A critical analysis. Psychosomatic Medicine, 1962, 24.

Lerner, B. Rorschach movement and dreams: A validation study using drug-induced dream deprivation. Journal of Abnormal Psychology, 1966, 71, No. 2, 75-86.

Meltzoff, J., Singer, J.L., and Korchin, S.J. Motor Inhibition and Rorschach Movement Responses: A test of the sensory-tonic theory. Journal of Personality, 1953, 21, 400-410.

Monroe, L.J., Rechtschaffen, A., Foulkes, D., and Jensen, J. The discriminability of REM and NREM reports. Journal of Personality and Social Psychology, 1965, 2, 456-460.

Oltman, Philip. Inspection procedure: Portable rod and frame test. Memorandum issued by Psychology Laboratory, Department of Psychiatry, Downstate Medical Center, January 1968.

Piotrowski, Z.A. Perceptanalysis. New York: The Macmillan Company, 1957.

Rechtschaffen, A., and Maron, L. The effect of amphetamine on the sleep cycle. Electroencephalography and Clinical Neurophysiology, 1964, 16, 438-453.

Roffwarg, H.P., Dement, W., and Fisher, C. Preliminary observations of the sleep-dream pattern in neonates, infants, children, and adults. In E. Harms (Ed.), Monographs on child psychiatry, No. 2. New York: Pergamon Press, 1964.

Sampson, H. Deprivation of dreaming sleep by two methods: I. Compensatory REM time. Archives of General psychiatry, 1965, 13, 79-86.

Sampson, H. Psychological effects of deprivation of dreaming sleep. Journal of Nervous and Mental Disease, 1966, 143, 305-317.

Schachtel, E.G. Projection and its relation to character attitudes and creativity in the kinesthetic responses. Psychiatry, 1950, 13, 69-100.

Singer, J.L. and Antrobus, J.S. Imaginal processes inventory. New York: The City College of the City University of New York, 1966.

Singer, J.L., Meltzoff, J., and Goldman, G.D. Rorschach movement responses following motor inhibition and hyperactivity. Journal of Consulting Psychology, 1952, 16, 359-364.

Snyder, F. In quest of dreaming. In Witkin, H.A. and Lewis, H.B. Experimental studies of dreaming. New York: Random House, 1967.

Snyder, F. The new biology of dreaming. Archives of General Psychiatry, 1963, 8, 381-391.

Vogel, G.W. REM deprivation: III. Dreaming and psychosis. Archives of General Psychiatry, 1968, 18, 312-329.

Vogel, G.W., Traub, A.C., Ben-Horin, P., and Meyers, G.M. REM deprivation: II. The effects on depressed patients. Archives of General Psychiatry, 1968, 18, 301-311.