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OBTAINING AND CORROBORATING REPORTS OF VERBAL DREAM EXPERIENCES

City University of New York PH.D. 1979

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by

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

1979

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

7/18/79
date

Chairman of Examining Committee

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Abstract

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by

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This study describes a method for obtaining more complete reports of verbal dream experiences than is usually obtained, offers a memory process explanation for why the method works, and possibly supplies corroboration for the subject's report of experiencing fully formed dreamt words.

By varying the circumstances in which dream reports are elicited from typical sleep laboratory procedures, more detailed reports of verbal dream experiences, including quotes and paraphrases of dreamt conversations, were obtained than are reported in most studies. The procedure in this study involved controlling the sequence in which aspects of the dream experience are reported so that, on some occasions, dreamt words would be reported before any other aspects of the dream experience are described. On these occasions, significantly more dreamt words were reported than on occasions when visual images were described first. The amount of reported visual imagery, however, did not differ significantly regardless of whether it was reported before or after verbal dream experiences.

A memory process explanation is offered for the usual dream study finding (that visual imagery, rather than verbal experiences, is typical of REM dream reports) involving the hypothesis that visual images are long-lasting in memory while verbal content is short-lived.

The findings of this study are consistent with this hypothesis and, if the hypothesis is correct, this study offers corroboration for the subjects' description of their dream experience as including fully formed mental words--i.e., if verbal material is short-lived in memory, then one would expect more dreamt words to be recalled immediately on awakening than after a delay caused by reporting visual imagery; conversely, as visual images are long-lasting in memory, then a delay (caused by reporting dreamt words) should not have much effect on the amount of visual imagery which can be recalled.

Acknowledgements

I am particularly grateful to Dr. John Antrobus, my thesis sponsor and mentor, for his relentless insistence on clarity as well as his guidance and encouragement through every stage of this dissertation research and preparation.

I also wish to thank Dr. Arthur Arkin and Dr. Howard Erlichman whose valuable suggestions contributed greatly to this paper.

Finally, my thanks to Mr. Stuart Rosenblatt for his help in running subjects and to Mr. Harry Lewin for help with the data analysis.

Table of Contents

Table of Contents

List of Tables

List of Exhibits and Figures

CHAPTER I

INTRODUCTION

The major goal of this study was to obtain as complete a description as possible of the verbal content of subjects' dream experiences. As part of this study, a more detailed qualitative analysis of reported verbal dream experiences will be provided than has, to the author's knowledge, been available in the literature previously.

A secondary goal was to explore the circumstances which favor more detailed reporting of verbal dream experiences in order to find an explanation for the relative infrequency of reported verbal as compared to visual dream experiences. A memory process explanation will be considered as an explanation for the infrequent report of verbal dream experiences.

The introduction explores the issues pertinent to this study's goals, and the interpretation of its findings with the following organization: First, other studies reporting dreamt words are briefly reviewed in order to illustrate the infrequency of reports of dreamt words compared to reports of visual imagery.

Then the relationship between reports of dreamt words and the nature of the dream experience is considered to explore the issue of whether reports of dreamt words mean that fully formed words were, in fact, part of the dream experience.

Thirdly a brief discussion of memory for sleep experiences in general sets the stage for considering why dreamt words would be infrequently reported if they were, in fact, common in dreams. This discussion requires a brief excursion into the area of waking memory for pictorial and verbal stimuli.

Finally, given the above, the predictions, goals and an overview of the method of this study are presented.

The above mentioned topics are discussed in order to deal with an important potential problem. One might say, given the relative infrequency of reports of dreamt words, that the simplest explanation is that words are rarely part of the dream experience. This introduction attempts to provide an answer to this point in three parts:

(1) There are some reports of dreamt words and reason to believe that the dream experience can actually include words, i.e., the few reports of dreamt words we have may not be just the result of a response style that transforms general dream experiences into reports of dreamt words (the first two sections of the introduction).

(2) There are sensible explanations involving memory processes and sleep laboratory procedures for why dreamt words are rarely reported (the last three sections of the introduction).

(3) This study, which varies sleep laboratory conditions in accordance with a memory process explanation for the infrequent recall of dreamt words, in itself provides suggestive evidence that the reported dreamt words were, in fact, related to verbal dream experiences. (the last section of the introduction and the rest of the paper).

As a preliminary step, some defintion of terms is in order. Underlying this research are the hypothetical constructs of mental images and mental words. While it is clear that neither objects, pictures nor words exist physically inside the skull, information exists (Kosslyn and Pomerantz, 1977; Pylyshyn, 1973; Anderson and Bower, 1973; Paivio, 1971). In conscious experience one is sometimes aware of an idea expressed in words, in a picture as an image in the mind's eye, or as a nonverbal-

nonpictorial impression or meaning. It is this difference in the experience which is pertinent here.

Mental words are defined as what one experiences in slow, silent reading or thinking in words. Generating mental words involves the transformation or recoding of ideas into words in all senses short of articulation (subvocal speech, Skinner, 1957). For the speaker, mental words have all the informational properties of acoustic words without vocalization.

Mental images are defined as the experience one has when visualizing an object which is not in sight. Generating mental images seems to involve the activation of the information processing system specialized for visual-spatial processing (Kimura, Seamon in Dimond, 1974; Kosslyn and Pomerantz, 1977; Peterson, 1975; Neisser in Paivio, 1971).

Reports of Dreamt Words

Visual imagery has been the main feature of reported REM mentation (Foulkes, 1966). There is, however, a small number of studies that discuss reports of auditory and verbal experiences. Snyder (1970) reviewed the work of early introspectionists such as Calkins (1893), Weed and Hallam (1896), Bentley (1915) and Knapp (1954). These investigators report what they call auditory imagery in 4% (Knapp) to 92% (Bentley) of their dreams. It is not clear in these reports how much of their auditory imagery is speech and how much is other, non-speech sounds. It is also unclear why there is such a great difference in incidence (or recall) of dreamt sounds.

In 1976, Antrobus, Schnee, Silverman, Lynn and Offer (A-3 study, unpublished) studied pairs of REM-NREM reports from 73 subjects. The incidence of reports of paraphrased conversations, quoted conversations

and visual imagery was obtained using our Psycholinguistic Coding Manual, which is discussed in the Methods section. We found (table 1) a low incidence of quoted or paraphrased conversations and a high incidence of reported visual imagery.

Salzarulo and Cipolli (1974) obtained 104 mentation reports from REM and NREM awakenings and got quotations of speech on 33% of REM and 4% of NREM reports. Descriptions of the content of dreamt speech were found in 25% of REM and 11% of NREM reports. An interesting aspect of their study was a linguistic analysis of the syntax of reported sentences, breaking sentences down into kernels plus transformations. They found quoted speech to be syntactically complex and suggested that REM sleep is a state in which linquistic structures could be formed and stored.

Snyder (1970) studied 635 REM dreams collected with several procedures and from several different groups. He found talking in dreams to be infrequent. The act of discussing or conversing was mentioned in passing in 86% of medium and long reports, and speech was quoted in 15% to 70% of reports from different groups and studies. Again, the large variation in frequency of reported verbal experience is not explained.

Cipolli and Salzarulo (1975) allude to the issue of report versus experience in a slightly different form from that mentioned in the early part of this introduction. They raise a question about the completeness of the report. They ask: Does the absence of a report about some aspect of the sleep experience indicate the absence of the experience? They decided to add a second question to the typical report elicitation procedure. On awakening, subjects were told "Tell

Table 1

A-3 Study Results - Percent of Subjects

Reporting Dream Content Scored in Each Category

Implicit Speech (Paraphrases)		Explicit Speech (Quotations)	
REM	NREM	REM	NREM
36%	11%	15%	4%

Visual Imagery (Visual nouns or "seen" objects)	
REM	NREM
86%	45%

based on 73 REM and 73 NREM reports

me everything that was going through your mind before you were awakened." If the mentation report did not include a reference to speech, then a second question was asked to the effect, "Was there any verbal activity in the dream, can you quote it?" On 66 of 104 awakenings, question two was asked and on 26 of these 66 occasions (39%), some verbal material was reported (nine quotations, five general descriptions of speech, and 12 times subjects said, yes, there was speech, but gave no information about it). The reader may compare this procedure with the "I SAW" awakening condition in this study (which will be described below).

From reviewing the above mentioned studies, we see that there are reports of dreamt words in the literature. But is a report evidence for the existence of the experience? This issue is considered in the following section.

Relationship Between Experience and Report

An issue which is basic, both to this study and to other dream mentation report collection studies, is the relationship between the dream report and the dream experience. Specifically, the question might be raised, does a report of dreamt words mean that mental words were, in fact, part of the dream experience? Of course, it is true that the same question might be raised regarding reported visual imagery, but since words have been a relatively infrequent and unpredictable part of dream reports, the question seems more pressing regarding the experience of mental words.

The dream experience is internal, not publicly observable. A goal of dream research has been to infer the nature of the dream experience from the dream report. Two studies can be cited which supply corrobora-

tion for the subjects' report of the nature of a sleep experience as "heard" or "spoken" words.

Arkin, Antrobus, Toth, Baker and Jackler (1972) report that talking during NREM sleep is associated with reports of verbal activity during the sleep experience. The dreamer was the speaker in the majority of those experiences.

More direct evidence for mental words in REM dreams comes from the work of McGuigan (1973) and McGuigan and Tanner (1971). McGuigan found that chin EMG activity was related to auditory hallucinations in schizophrenics. He also found that normal subjects doing silent reading had elevated EMG from the throat. Then, McGuigan and Tanner did a sleep study with four subjects and got eight dreams classified as visual and five dreams they classified as conversational in content. They found that lip and chin EMG's were significantly higher in REM periods with conversational dreams than during the preceeding NREM period. On the other hand, there were insignificant differences in EMG between REM periods from which visual dreams were elicited and the preceeding NREM EMG levels.

These two studies illustrate techniques which tend to corroborate the subjects' reports and lend support to the idea that mental words were, in fact, experienced by the sleeper. This study, as will be described below, also offers suggestive evidence that reports of dreamt words are indeed related to verbal experiences during sleep, by showing that the circumstances which favor the recall of dreamt words are consistent with what we know of memory for other dreamt material, and also consistent with what we know of memory for pictures and words.

Before this issue can be discussed further, several points about

the memory for dreams and for pictorial and verbal situmli experienced while awake must be raised.

Frequency of Dream Recall and Memory Processes

The introduction of the polygraph to the sleep laboratory by Dement and Kleitman (1957) demonstrated that most people dream approximately five times per night. However, the frequency of dream recall is usually much lower; some people hardly ever recall dreams, while many people recall a dream perhaps once a week (Hall, 1972).

Why is there such a discrepancy between the frequency of dreams and the frequency of dream recall? In a recent review of the dream recall literature, Koulack and Goodenough (1976) pointed out the following:

(1) that there have been two major types of explanations for people's failure to recall dreams -- psychodynamic explanations involving repression, and memory process explanations involving factors such as decay, interference and consolidation;

(2) that psychodynamic explanations (which explain recall difficulties in terms of dream content interacting with psychodynamic forces) are not sufficient, and that memory process factors are required to explain the effect of sleep on dream recall.

Koulack and Goodenough report two other key generalizations about the conditions under which sleep experiences can be recalled. The first is that dreams tend to be recalled easily only if the sleeper is awake within a matter of seconds after the experience occurs. The second is that distractions at the moment of awakening impair dream recall. These observations about the rapid decay, so to speak, of dreams and the effect of distraction (interference) are applied in this

study to particular types of dream content, images versus words, in an attempt to explain why visual imagery tends to predominate in dream reports.

To be specific, the suggestion is made that typical sleep laboratory procedures favor the recall of visual imagery and bias against the recall of dreamt words. This idea is discussed in more detail (in the last section below) following a brief discussion of memory for pictorial and verbal stimuli.

Memory Processes and the Dream Report

In this section, we will explore the possibility that what we know of memory for pictures and words experienced while awake may be relevant to the dream report situation. Specifically, the question is, is there a memory process explanation for the fact that dream reports are more likely to be of visual rather than verbal experiences?

In Bransford and Franks' study (1971), a filled delay between learning and recall made it less likely for exact quatations of stimulus words to be recalled. Instead of quotations, paraphrases or general descriptions of sentences were recalled after a delay. This fact about recall for words experienced while awake may be relevant to the dream report situation. What if mental words were "spoken" by dream characters, experienced by the sleeper, but then quickly forgotten, with only the meanings of events of the dream being recalled? The dreamt conversation "Pass the salt, please. Okay, here it is.", may be reported as "I wanted the salt and John gave it to me."

This loss of memory for specifics is easy to accept, but, given a dream which included both images and words, the question for this study is, would we expect that people would remember the images better than

the words?

There is a body of scientific opinion and of folklore which suggests that images are easier to recall than words. There is also a compelling argument that says we cannot fairly compare the two. First, the opinion and folklore.

From the time of Simonedes (Luria, 1968), the ancient Greek orator, a visual imagery mnemonic has been known. Simonides trained his students to memorize a series of locations or views of a building or road and associate each image with an idea from an upcoming speech. Then, by mentally walking through the building and imagining each scene, the main sections of the speech would be recalled in order. This technique illustrates the lengths to which orators would go to have recall based on images and meanings, rather than trying to recall individual words.

Luria (1968) also described a living man with an unusual memory in this book. That man could spontaneously form images which symbolized any information he was exposed to, and retain the information indefinitely. For example, he could recall matrices of numbers 100 x 100 digits perfectly over years, and recall any subset of the numbers on demand. Other stage mnemonists are reported to have trained themselves using an imagery technique like Simonides' (Paivio, 1971).

Bugelski (in Paivio, 1971) developed a one-bun, two shoe imagery recall technique using controlled laboratory tests and found that subjects using imagery recalled word lists better than did subjects not instructed to use images. In this study, the same information was to be recalled, word lists, but the instructions and reported experience of the subjects using image mnemonics supports the conclusion that images are easier to recall than words.

A number of experiments showed that large numbers of pictures could be learned on a single exposure (Standing, 1970, 10,000 pictures; Standing, Conzio and Haber, 1970, 2,500 pictures on a single trial; Nickerson, 1965, 95% correct in picture recognition; Shepard, 1967, even higher percentages). These results are reviewed by Green and Purohit, who say that memory for pictures is "surprisingly good ... in marked contrast with [results] obtained in a variety of other storage and retrieval tasks."

Paivio (1970) presents a detailed theoretical model to account for the picture superiority effect involving coding differences for visual and verbal information. His model is still being developed (and attacked) but has withstood a number of important tests (Paivio and Csapo, 1973; Anderson, 1976).

The point of view which comes out of the above is that the phenomenology of pictures and images being associated with unusually good memory, while specific words (Bransford and Franks, 1971; Bartlett, 1932; and other references above) are forgotten very quickly, supports an analogy to the dream report situation. It is possible that dream reports have typically emphasized descriptions of visual imagery because the images were easily recalled. Quotations of dreamt words are less common, perhaps, because the words tend to be forgotten.

As mentioned above, there is a compelling objection to the argument that memory for pictures and words can be fairly compared (Mandler and Parker, 1976; Mandler and Johnson, 1976; Mandler and Ritchey, 1977). Mandler and her coworkers point out that, while picture memory seems excellent, a metric for a bit by bit comparison of the information content of pictures and words is not available. This means that when

a picture or a string of words is recalled, we cannot really tell which report contains more information. Also, since the stimuli themselves cannot be quantified on the amount of information they contain, we cannot tell if the amount recalled after exposure to a pictorial and a verbal stimulus represents the same proportion of information present in the stimuli.

Mandler and her coworkers make another telling point. They suggest that, to some degree, picture memory is not really recall, but is reconstruction. They suggest that schemas exist which help memory for "organized" stimuli (stimuli which represent aspects of the real world in familiar contexts). The amount of help these schemas might be for pictures versus word stimuli is simply unknown.

What implications do all of the above (scientific opinion, folklore and Mandler's work) have for understanding the content of dream recall? As pointed out by the authors mentioned above (and not disputed by Mandler), memory for visual images seems better than memory for words. While Mandler quite rightly points out that the comparison may not be a fair one, she does not dispute the observation. Therefore, the fact that REM dream reports are more likely to include descriptions of images than quotations of words (regardless of the amount of information in such descriptions or in the original stimuli) makes the dream report situation consistent with out observations regarding recall of pictures and words experienced while awake.

The conclusion one may draw is that, regardless of the amount of information in visual versus verbal parts of a dream experience, the tendency to recall and report visual imagery rather than words is consistent with observations of recall for stimuli experienced while

awake. Therefore, the relative infrequency of reports of dreamt words is, in fact, to be expected and should not be considered strong evidence for the infrequency of verbal dream experiences.

Further, based on the pictorial superiority effect mentioned above, we would not be surprised if decay and distraction had less of an apparent effect on recall for dreamt images than on recall for dreamt words.

In fact, if we found that such factors affected reports of dreamt words while not affecting reports of dreamt images that would be consistent with observations about recall for pictorial and verbal stimuli experienced while awake, and therefore provide inferential support for the existence of words and images in the dream experience. In effect, finding this similarity between recall for waking stimuli and recall for dreams would allow for corroboration of the subjects' reports, i.e., that images and words were actually experienced.

Mandler quite rightly points a cautionary finger at such attempts to compare visual and verbal recall. While available techniques cannot overcome Mandler's objections, the current study attempts to reduce the chances of obtaining misleading findings by comparing (using the Psycholinguistic Coding Manual described below) reports of visual imagery only with other reports of visual imagery and not with reports of dreamt words. Likewise, the number of dreamt words reported under different conditions are compared.

While this attempt to deal with Mandler's point is not perfect (we cannot be sure that the imagery metric is as sensitive as the word metric), it is the best way at this time to investigate visual and verbal dream content. Any interpretations drawn from this part of the

analysis, concerning corroboration of the content of the subjects' dreams would be considered suggestive, not conclusive.

Overview of This Study

While the absence of quoted words in most REM mentation reports would seem to favor meanings as the form of dream experience rather than words, there is another explanation for the usual finding. Procedures in most sleep experiments may bias reporting in favor of visual experiences and against verbal experiences. In typical sleep report procedures, a subject is awakened in a dark room by the sound of an experimenter calling the subject's name. The subject responds to the call and then hears an instruction or question such as "Tell me everything that was going through your mind before you were awakened." The subject begins reporting and may be prompted or asked other questions at pauses.

While the complete darkness of the sleep room will not interfere with visual memories, the verbal stimuli of the call to awaken and the following questions and answers may interfere with memories for verbally coded information. This reason for typical REM report content would be a specific case of a retroactive inhibition phenomenon (Ceraso, 1967). Thus, the procedure favors recall of visual over verbal experiences.

Other factors are also possible sources of biased reporting. It is a common experience on awakening to remember a long dream, but as one thinks or talks about some events, one experiences the loss of memories for the rest of the dream. As the subject gives a dream report, parts of the sleep experience are being forgotten. The parts which are

forgotten as a result of this delay are not under the control or observation of the experimenter. Two reasons may be offered why visual rather than verbal material could be favored under these circumstances:

(1) Visual images may be more interesting or salient and will, therefore, be reported first.

(2) Visual images, favored by sleep laboratory procedures, may be clearer in memory than mental words, and therefore be reported first. Those experiences reported first are less likely to be forgotten (Dalezman, 1976).

Also, a subject does not offer a movement by movement analysis of each action he "sees" in his dream, but gives a general description saying, perhaps, "John walked down the hall looking from right to left", not "John moved his left foot while swinging his right arm forward, then swung his arm back and moved his right foot forward, etc." Likewise, subjects might feel that, by saying "I wanted the salt and John gave it to me" rather than "I said, 'Please pass the salt' and John said, 'Okay, here it is.'", that they are conveying a complete account of their experience.

Some simple procedural differences from the typical sleep experiment are intended to reduce interference with verbal memory and also to bring under the experimenter's control the decision as to which parts of the sleep experiences would be reported first. Instead of a verbal call, the awakening stimulus will be one or more loud beeps over the intercom. On awakening, the subject will not receive instructions aurally, but visually in the from of an illuminated sign. The sign (as per pre-sleep instructions) will inform the subject what aspect

of the sleep experience is to be reported first. Instead of leaving this to the subject's discretion, there will be systematic variation of whether visual or verbal experiences are reported first. After reporting the called for information, the subject would automatically continue reporting everything else he or she can recall about the sleep experience.

The major prediction is that reports of Heard First awakenings (when dreamt words are to be reported first) will include quoted conversations which were not reported in many previous studies. By extrapolation from perceptual research (Paivio, Luria, Seamon, Peterson, cited above) on the mnemonic value of images in producing accurate long lasting memory, one would predict that details of the visual experience will still be reported after reporting conversations. Reporting imagery first, however, is predicted to reduce the amount of reported verbal experience, since specific words disappear from memory either as a result of interference by spoken words or as a result of rapid decay.

If the above predictions are borne out by the data, this study will serve two major purposes:

(1) It will provide a method for obtaining more complete descriptions of the dream experience than has been available before.

(2) It will provide inferential support for the idea that mental words are, in fact, part of the dream experience in three ways:

(a) by obtaining reports of dreamt words;

(b) by showing that there is a systematic relationship between sleep laboratory procedures and the frequency of such reports, indicating that haphazard factors (such as response style) cannot explain away such reports;

(c) by providing suggestive evidence that the recall of visual and verbal dream experiences shows the same interference effects as do recall of pictorial and verbal stimuli experienced while awake, which would tend to corroborate the subject's description of the dream content.

CHAPTER II

METHODS AND PROCEDURE

Subjects

Twenty-eight (28) subjects, 16 male and 12 female between 18 and 35 years of age, were selected on the basis of their claims of being good sleepers and frequent dream recallers. Four subjects, not included in the above, were eliminated either because they did not show up for the second night of the study, or because they did not sleep or recall dreams on the first night.

The criteria for being considered a good sleeper involved consistency in bed time and wake up time, spending at least six and one half hours in bed on typical nights, ease of falling asleep and infrequent need to get out of bed during the night. Subjects were people whose normal bedtime was between 10:00 P.M. and 1:00 A.M., and whose normal wake up time was between 6:30 A.M. and 9:00 A.M. People who reported that it took them in excess of thirty minutes to fall asleep, or who reported difficulty in falling back to sleep after awakening during the night were not used as subjects.

Frequent dream recallers were defined as people reporting that they remember experiencing at least one dream per week, so a telephone interview was conducted with prospective subjects and, in addition to the above criteria, people were excluded if they reported believing that dreams could predict or influence future events. This stipulation was to avoid the possibility of experiences in the laboratory causing undue anxiety or otherwise influencing a person's behavior after the experiment. Individuals who could not or would not respond clearly to questions about sleep habits and frequency of dream recall were not used

as subjects.

Because of their convenient location, willingness to come to City College at night and flexible daytime and evening schedules, Columbia and Barnard students were preferred subjects and made up 36 percent of the sample. Subjects claimed to be free of all medication, drugs and alcohol on the two days of the experiment and for at least two days before. Subjects were paid twenty dollars each.

Apparatus and Bio-Potential Recording Techniques

A Beckman Instrument Co. Type R Dynograph was used for recording electroencephalograph (EEG), electromyograph (EMG) and electrooculograph (EOG) readings. Beckman Instrument Co. silver-silver chloride pellet electrodes were used for all sites except the ear lobe reference and the forehead ground, where Beckman Instrument Co. silver cup electrodes were used.

EEG recodring (see the appendix page 61 for the amplifier settings, time constants, etc.) was done from scalp electrodes at C3 and C4 (left and right central) and O4 (right occipital). Reference electrodes at the left mastoid bone and right ear lobe were used. The combination of central lead and reference which resulted in the most noise-free recording (by visual inspection of the record) was used.

Scalp electrodes were attached using Beckman adhesive collars and electrode paste with surgical tape over everything else. The site was found using the Rechtschaffen and Kales Manual (1968) as a guide. Hair was then carefully parted and pinned back. The site was swabbed with alcohol and allowed to dry before the electrode, with both a large and small collar trimmed to fit the long narrow part, was pressed firmly onto the scalp and held for a few seconds to allow the electrode paste

and collars to adhere. Then, surgical tape was applied in several layers, each pressed firmly around the electrode, onto the part and onto the surrounding hair. When finished, pressing on the electrode top would not produce any downward movement, indicating that the electrode was in contact with the scalp.

EOG recording was done from the outer canthus of each eye, with one electrode placed slightly above and the other slightly below the approximate center of the eye socket. Attachment was done as for scalp electrodes with collars, paste and tape. Each electrode was referred to the mastoid electrode or ear lobe and bipolar eye movements were recorded on a separate channel by referring the two eye electrodes together.

Two EMG electrodes were placed below the chin on the submental muscle and held securely in place by adhesive tape. The electrodes were referred to each other. The forehead ground and ear lobe reference were attached using electrode paste and surgical tape. The mastoid reference was attached like a scalp electrode. The braid of all ten electrodes was clipped to hair at the back of the head to prevent body movements from pulling electrodes off the scalp. Six channels of the dynograph were used for recording bio-potentials from the left eye, right eye, bipolar eye movements, central EEG, occipital EEG and EMG.

Scoring Mentation Report Content

Dement and Kleitman (1957) found a differential probability of getting a mentation report from subjects awakened from REM periods compared to NREM awakenings. The next step was to examine the content

of these reports. Reading of sleep mentation reports yields a general impression that REM reports describe more visual imagery and seem to fit the common notion of what a dream consists of, while NREM reports seem more thoughtlike. From such observations, investigators developed global rating systems for sleep mentation reports. In such a system, judges would be given minimal instructions, actually not much beyond dictionary definitions, and would then rank order two or more reports on scales called "visual imagery" or "dreamlike quality." An example of such a rating system is described in "Global Ratings of First Night Reports" (Antrobus, Schnee, Lynn, Silverman and Offer, 1976), where the scores differentiate REM from NREM reports with an accuracy of well over 90%. The weakness of such global ratings is that much of the basis for the complex multivariate judgments is covert, i.e., occurs secretly inside the minds of the judges.

The authors of the paper mentioned just above have worked to operationalize more clearly the quantitative and qualitative differences between reports of REM and NREM mentation. The results of this effort, Psycholinguistic Coding Manual for Reports of Sleep and Stimulus Independent Waking State Experience (Schnee, Antrobus, Lynn, Silverman and Offer, 1976; and Antrobus, Schnee, Lynn, Silverman and Offer, 1976b) are a detailed set of rules for counting words in mentation reports which provide information about the experience of the sleeper, providing ordinal scaling of reports on total content, or total amount of information reported, four scales for visual imagery, two scales for aural verbal experience and ten other scales. The advantage of this system is that the rules leave less latitude for covert complex judgments and result in not only a number of scored words, but the scored words them-

selves which indicate the parts of the reports that are used by judges to determine the nature of the sleep experience.

Scores on the visual imagery scales differentiate REM from NREM reports with approximately 90% accuracy. These scales, plus scales for quoted and paraphrased conversations will be used to measure the effects on recall performance of the awakening conditions and instructions employed in this study.

In the coding manual judges received detailed instructions on how to choose which words in a mentation report convey information about the sleep experience. Those words which were judged informative and not redundant were counted producing a quantiative measure of the sleeper's experience. The scales used were:

Visual imagery in four categories:

Visual Nouns - words designating objects or characters "seen" by the sleeper;

Visual Modifiers - words giving added information about the appearances of Visual Nouns;

Visual Action - words describing movements of Visual Nouns;

Spatial Relations - words describing location in space of Visual Nouns.

Auditory experience in two scales:

Implicit Speech - paraphrases or specific descriptions of "heard" conversations;

Explicit Speech - verbatim quotations of "heard" conversations.

Four judges rated each report and the average of the scores is the measure used. The judges were trained and tested in the manner prescribed in the Psycholinguistic Coding Manual and their judgments were highly reliable.

Since there has been relatively little discussion of the nature or quality of dreamt conversations compared to the literature on visual imagery, a description of dreamt speech will be offered. For REM dreams, the number of utterances and words per utterance will be counted. Also, the experimenter will judge who the speaker was, whether the dreamt words were relevant to other dream content, and whether the quality of dreamt speech seems like normal waking speech, or if it has the quality of telegraphic of written English. These qualitative judgments, while not taken as support for the main contention of the study (that dream conversations occur), are reported to provide information not usually offered in papers on dream content.

Experimental Conditions

There were two types of awakenings for mentation reports, visual first (I SAW) and verbal first (I HEARD). On I SAW awakenings, subjects were to first report everything they "saw" during the dream and then report everything else they could recall of the dream experience, including what they "heard". On I HEARD awakenings, subjects were to first report any conversations they "heard" and then everything else they could recall, including what they "saw". Subjects were told that, as soon as they heard the intercom buzzer, they were to say "I'm awake" (which signals the experimenter to stop buzzing), and to open their eyes and note which

of two signs at the foot of the bed was illuminated. One sign said "I SAW", indicating a visual report first awakenings, and the other sign said "I HEARD", indicating a verbal report first awakenings.

Procedure

Subjects were instructed to arrive at the laboratory two hours before their intended bedtime. This allowed time for subjects to acclimate to the lab, for giving of instructions and for electrode application. On his or her arrival, the subject was shown the sleep room and the procedure of electrode attachment, awakening for reports and payment was explained, as it was during the phone interview. Any questions about the procedure were answered and then subjects were asked to give their informed consent.

Instructions read by the subject before retiring and reviewed orally by the experimenter just before lights were turned out for the night, indicated the following:

(1) That this was an experiment on memory during sleep, and therefore subjects should try to remember and describe in great detail everything they experienced before the buzzer;

(2) That the illuminated sign indicated what part of the sleep experience, visual imagery or conversations, would be reported first;

(3) That on seeing "I HEARD" they should say "I heard" followed by an exact quotation of all the words they remember hearing before the buzzer. If exact words could not be recalled, then conversations should be paraphrased or described in as much detail as possible, and that subjects should indicate whether they were quoting or paraphrasing. After reporting all words heard during the dream, subjects should des-

cribe everything they "saw", "did" or experienced in as much detail as possible;

(4) That on seeing "I SAW", they should say "I saw" followed by a detailed description of all the visual images experienced during the dream. After describing everything they "saw", they were to report all the words they "heard", preferably as quotations, as well as everything else they "did" or experienced in as much detail as possible. The "Instructions to Subjects" as seen by subjects are presented on the next two pages (Exhibit I).

Therefore, on each awakening, a complete report of visual imagery, verbal material and everything else experienced was elicited. Only the sequence in which this information was to be given was varied. It should be noted that a report was elicited without any verbal communication from the experimenter. If the subject said nothing within 15 seconds after two intercom buzzes and the polygraph record indicated that the subject was awake or moving, the experimenter would prod the subject by saying "I heard" or "I saw", whichever was appropriate for this awakening. When the subject stopped speaking for 15 seconds (unless he or she indicated that he or she was thinking of what to say next), the experimenter would say "Any more detail to this?". This question would be asked once for each awakening.

Awakening Criteria

The experimenter attempted to make a REM and Stage 2 NREM awakening for "I HEARD" reports and also for "I SAW" reports, making four mentation report awakenings for each of the two nights. Sleep stage scoring followed the Rechtschaffen and Kales manual (1968) with the following two

Exhibit I - Instructions To Subjects

We are interested in all the words, images, thoughts, dreams, feelings and anything else that was going through your mind during sleep. We are also interested in everything you can remember about the film you will see.

During the course of the night you will be awakened several times. We will sometimes ask you to tell us about the film you saw. On other occasions you will see a lighted sign telling you to describe what was going through your mind during sleep. We will also ask you for reports while you are awake.

We want as much detail as possible in your reports. If you remember that people were speaking in your dreams (or in the film) try to quote the conversation exactly. Report as many specific words as you can. If you remember that there was a conversation but you can't remember the exact words then tell us this and give as much detail about the topic that was discussed as possible. Any questions?

We also want a complete description of the visual images you remember seeing. Describe all the people, objects or other things you saw in as much detail as possible. Also report the thoughts, feelings or anything else that was going through your mind before you were awakened. Any questions?

Sometimes you can know something about a person, such as whether or not he is angry, by the way he looks, or the way he sounds, or by what he does. So there could be various sensory cues which would give you information about people and events. In your dream and film reports instead of just saying someone was angry, or in a hurry, also describe what you saw or heard which gave you this information. Any questions?

There are two signs in the sleep room. The first thing to do upon awakening is to say "I'm awake." Then open your eyes and look to see which sign is illuminated. As soon as you see the signal, which will be explained later, begin your report. The microphone which will pick up your report is directly over the bed so I'd like you to lie on your back while speaking. Speak as clearly as possible. Often people awakened at night are hard to understand.

At times you may feel that you don't want to tell me some aspect of your sleep experience. Of course we would like as much detail as possible, but if you decide not to tell us something (and this is your right) we would at least like to know that you are witholding something. Please tell us as much about the experience as you don't mind relating. Any questions?

People sometimes drift off to sleep after being awakened without fulfilling instructions. If this happens you will be reawakened and you will know that you must try harder next time.

Exhibit I - Instructions To Subjects (continued)

You will be awakened several times during the night by a beeping sound over the intercom. As soon as you hear the sound say "I'm awake." Then open your eyes. A dim light will be lit showing the words "I SAW" or the words "I HEARD".

When you see "I SAW"

When you see the words "I SAW" you are to immediately begin reporting all the things you saw during your dream. Try to give a complete description of the appearance of the people, objects, places and anything else you saw during sleep.

Begin your report with the words "I SAW" and don't report any other elements of the within sleep experience or any waking thoughts until you have reported all the visual material from the dream that you can remember.

After you have described everything you saw during sleep you are to report other aspects of the sleep experience such as the words and sounds you heard, the actions of dream characters and any thoughts or feelings you had during the dream.

When you see "I HEARD"

When you see the words "I HEARD" you are to immediately begin reporting all the words that characters in your dream were saying. Try to give exact quotations but if you can't then paraphrase the conversations as closely and in as much detail as possible. Tell us whether you are quoting or paraphrasing.

Begin your report with the words "I HEARD" and don't report any other aspects of the within sleep experience or any waking thoughts until you have reported all the verbal material from the dream that you can remember.

After you have quoted or described all the words you heard during sleep you are to report other aspects of the sleep experience such as the visual images you saw, the actions of dream characters and any thoughts or feelings you had during the dream.

On some awakenings no light will be lit. Instead, you will receive instructions over the intercom telling you to report everything you recall about the film you saw instead of reporting on your dream.

Review

When you see "I HEARD" begin your report with the words "I HEARD" and report all the words you can remember hearing. Then report everything else you recall about your dream.

When you see the words "I SAW" begin your report with the words "I SAW" and report all the things you remember seeing. Then report everything else you recall about your dream.

Any questions?

changes. Sleep-wakefulness was determined by alpha activity from the occipital rather than the central lead and the bipolar eye movement channel as well as the single eye movement channels was watched for slow rolling eye movements indicative of stage one sleep.

Awakenings were made after ten minutes of an uniterrupted stage except for the first REM awakening of the night, which followed five minutes of REM sleep. Since the first REM period of the night seldom lasts ten minutes, this reduced criterion increases the chances of making the full complement of awakenings each night. When possible, a Latin square counterbalancing system for order of awakenings was employed. However, individual differences in distribution of sleep stages during the night forced the experimenter to make many awakenings disregarding this scheme. The alternative would have been to make far fewer awakenings over the same number of nights.

The subjects in this experiment participated simultaneously in another experiment. Before retiring, subjects were shown brief sound, color cartoons. On two occasions each night, subjects were awakened and asked to describe a cartoon previously seen. The results of that experiment are not part of this paper.

CHAPTER III

RESULTS

It is recalled that there are two awakening conditions: I SAW, where "seen" images are reported first, and then words and any other dream experiences are reported; and I HEARD, when any "heard" words are reported first and then images and other dream experiences are reported. The four judges rated each report on six scales of the Pyscholinguistic Coding Manual.

Summary of Scales:

Visual Nouns - words designating objects or characters "seen" by the sleeper (VN);

Visual Modifiers - words giving added information about the appearance of Visual Nouns (VM);

Visual Action - words describing movements of Visual Nouns (VA);

Spatial Relations - words describing movements of Visual Nouns (SR);

Implicit Speech - paraphrases or specific descriptions of "heard" conversations (IM);

Explicit Speech - verbatim quotations of "heard" conversations (EX).

For each subject there were at least four awakenings: REM I SAW, REM I HEARD, NREM I SAW, and NREM I HEARD and, therefore, four reports. For many subjects, more reports were obtained over the two nights of the experiement, eleven being the largest number of reports elicited from one subject. For each report, an average of the judges' ratings

was taken on each scale as described in the Methods section.

In order to compare the results of subjects who were awakened different numbers of times, an average of scores for each awakening condition and sleep stage was taken. That is, if three REM I SAW reports were obtained from a subject, the mean of the ratings on each variable was computed and that was the value used in the analysis. So for each subject, a score on each of the six scales was available for each awakening condition and sleep stage.

There were many reports with no content (no words counted by judges as descriptive of a sleep experience) in NREM, and considerable differences in lengths of reports in REM. Therefore, a transformation of the data was performed $[\log_{10}(x+1)]$ to reduce skewness and increase the homogeneity of variance. The transformation was performed before any averaging of scores was carried out so a mean of logs was obtained.

Differences between reports on I SAW and I HEARD awakenings would provide the test of the inferences about verbal experiences during sleep, so for all scales, the mean I HEARD scores over subjects was subtracted from the mean I SAW score and the difference was compared to zero. A multivariate analysis of variance procedure, the General Linear Model of MANOVA, was the form of the data analysis.

Until the model for multivariate matched t test (Timm, 1975) became available, it was the general practice to make a series of correlated t tests between two conditions on each of the dependent variables employed. The one sample matched subjects t test permits a test between the two conditions simultaneously on all the dependent variables used. The comparisons of specific variables have the additional advantage of protecting the investigator from spureously

significant differences produced simply by the large number of comparisons made. All significance tests were carried out at the .05 level unless otherwise indicated.

The possibility of an interaction between REM/NREM (sleep stage) and I SAW I HEARD (awakening condition) was checked. Table 1 shows that the overall interaction yielded an F value of 2.36 (df 6,22 $p \leq .065$). The F value of explicit speech also approached significance ($p \leq .10$). While the standard significance level was not obtained, the results do not allow us to accept (fail to reject) the null hypothesis and assert that there was no interaction between sleep stage and awakening condition. Therefore, the results for REM and NREM awakenings will be considered separately.

Looking at REM and REM awakenings separately on the I SAW and I HEARD conditions in Table 3, we wee that overall, the difference between I SAW and I HEARD is significant. Looking at the individual scales for REM awakenings, we see that the only significant difference is for Explicit Speech, more quoted words being reported on I HEARD than on I SAW awakenings. On NREM awakenings, the only difference which approaches significance is for Visual Modifiers ($f=4.07$ df1, 27 $p \leq .054$), more Visual Modifiers being reported on I SAW than on I HEARD awakenings.

The relation between visual and verbal scores and awakening conditions is illustrated graphically in Figure 1 and Figure 2. For REM awakenings, the differences are largest for Explicit Speech and smaller for Implicit Speech and the visual scales.

Table 2

Interaction of I SAW/I HEARD with REM/NREM

$\overline{VN}$

	R	NR
S	.9184	.2419
H	.8274	.2175

F = .64
(1,27)

$\overline{VM}$

	R	NR
S	.7040	.1869
H	.5694	.0781

F = .18
(1,27)

$\overline{VA}$

	R	NR
S	.4183	.1216
H	.4240	.0372

F = 2.17
(1,27)

$\overline{SR}$

	R	NR
S	.3843	.2149
H	.3141	.0868

F = 0.0
(1,27)

$\overline{TM}$

	R	NR
S	.6395	.1106
H	.8075	.3223

F = .08
(1,27)

$\overline{EX}$

	R	NR
S	.4240	.0327
H	.6810	.1138

F = 2.96
(1,27)

Interaction Over All Variables

Hotelling t^2 $F(6,22) = 2.36$ $p \leq .065$

The interaction between sleep stage (REM/NREM) and awakening condition (I SAW/I HEARD) on six scales of the Psycholinguistic coding manual is shown. None of the F values for individual scales is significant, but the explicit speech F value approaches significance ($p \leq .10$). The overall interaction approaches significance. See page 29 for definition of abbreviations.

Table 3

Mean Transformed Scores for I SAW and I HEARD

Awakenings for REM and NREM Separately

	Visual Nouns	Visual Modifiers	Visual Action
REM I SAW	.9184 F = 1.27 (1, 27)	.7040 F = 3.32* (1, 27)	.4183 F = 109 (1, 27)
REM I HEARD	.8274	.5644	.4365
	Spatial Relations	Implicit Speech	Explicit Speech
REM I SAW	.3843 F = 1.09 (1, 27)	.6395 F = 1.51 (1, 27)	.4240 F = 5.39** (1, 27)
REM I HEARD	.3141	.8075	.6810

	Visual Nouns	Visual Modifiers	Visual Action
NREM I SAW	.2419 F = .19 (1, 27)	.1869 F = 4.07* (1, 27)	.1216 F = 3.68* (1, 27)
NREM I HEARD	.2175	.0781	.0372
	Spatial Relations	Implicit Speech	Explicit Speech
NREM I SAW	.0868 F = 3.86* (1, 27)	.1106 F = 3.29* (1, 27)	.0327 F = 2.02 (1, 27)
NREM I HEARD	.0163	.3223	.1138

* = $p \leq .10$

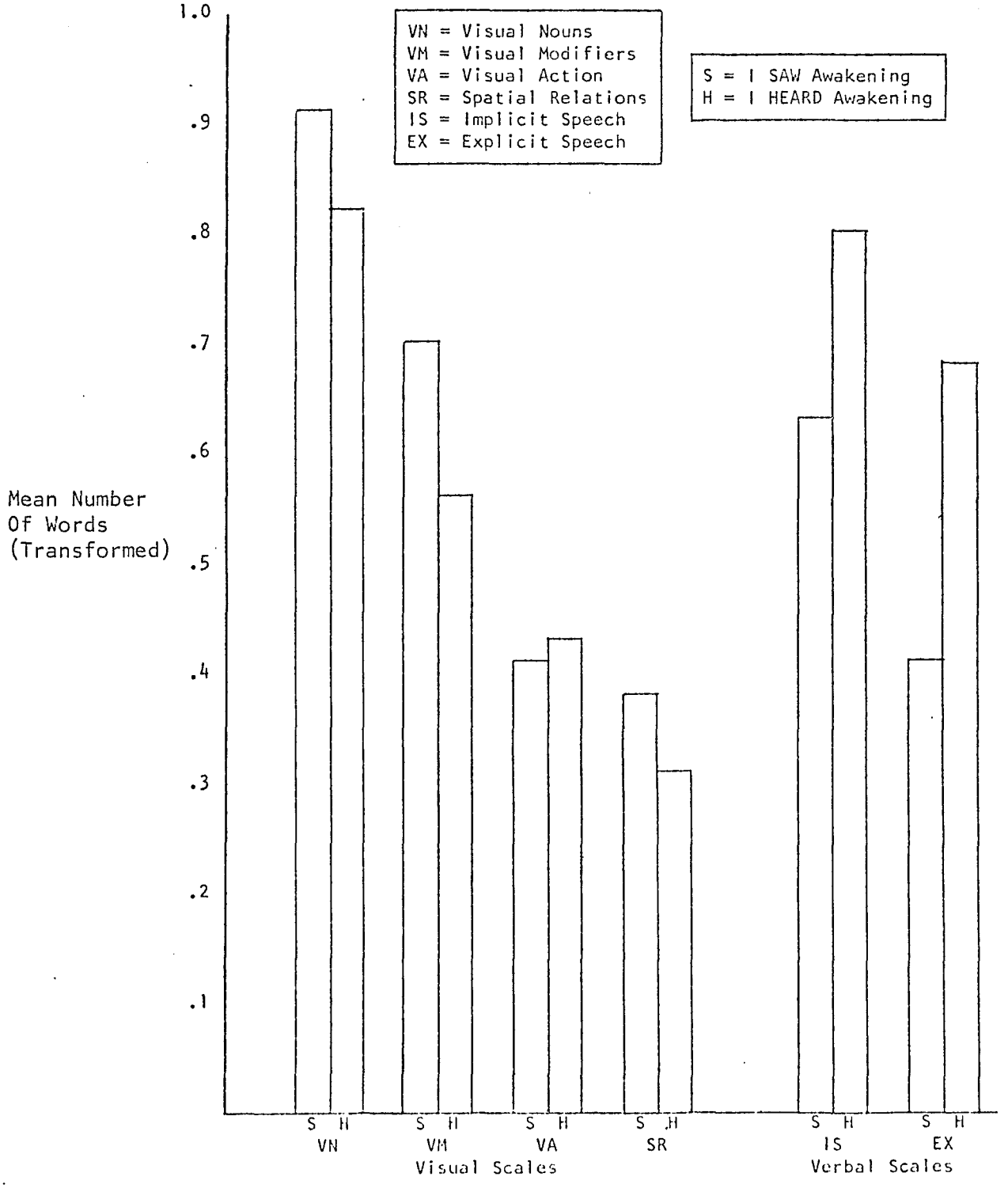
** = $p \leq .05$

Overall-all 12 Variables Hotelling t^2 F = 2.75**

Overall, the difference between I SAW and I HEARD is significant. The only scale with a significant value difference between I SAW and I HEARD scores is Explicit Speech on REM awakenings.

Figure 1

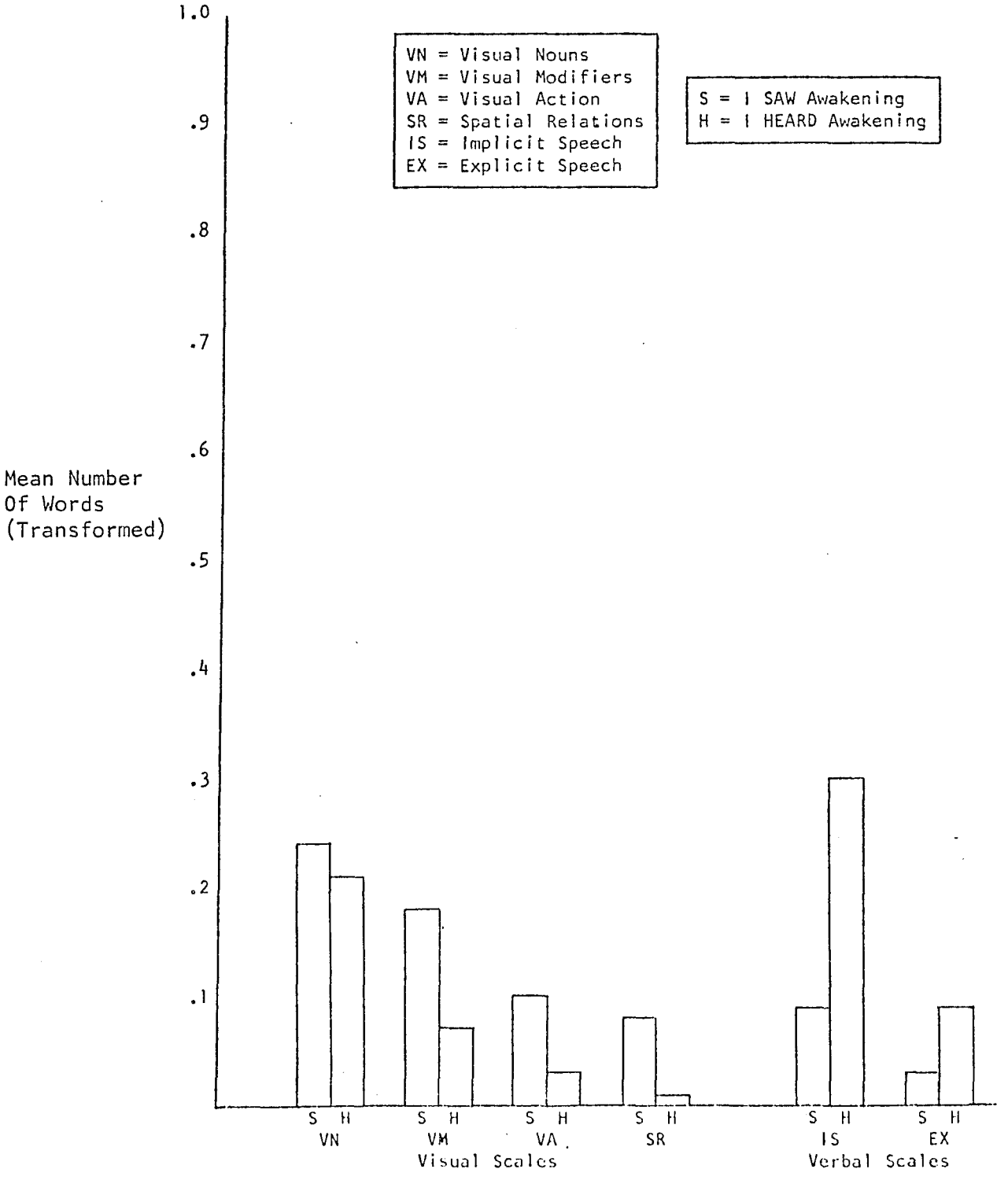
GRAPHIC DISPLAY OF MEAN I SAW/I HEARD SCORES FOR REM AWAKENINGS



This graph illustrates the finding that the differences in recall between awakening conditions are greater on verbal than visual scales. More quoted and paraphrased words are recalled on I HEARD than I SAW awakenings. The difference for explicit speech is significant.

Figure 11

GRAPHIC DISPLAY OF MEAN I SAW/I HEARD SCORES FOR NREM AWAKENINGS



This graph illustrates the finding that there were few scored words for NREM awakenings on any scale than was scored for REM awakenings (see Figure 1). None of the differences between awakening conditions are significant.

The Nature of Reported Verbal Experiences

REM I HEARD Explicit Speech

Sixty-one quotations of dreamt speech were reported in the 57 REM I HEARD dream reports (see Table 4). The average number of words per quote for REM I HEARD awakenings was 8.1. Fifty-six of the 61 quotations were judged to be relevant to the dream context, most speech was in the form of conversations rather than monologues and had the quality of normal spoken English, rather than being telegraphic of having a written or literary quality. The dreamer was the speaker for 21 of the 61 quotations.

REM I HEARD Implicit Speech

There were 79 paraphrases reported in the 57 reports with an average of ten paraphrased words per reported utterance. The same pattern of findings as for explicit speech is present, i.e., the dreamt words were in the context of other dream events, were in the form of conversations rather than monologues, and dream characters other than the dreamer were more often the speakers. Since the exact words of the speech were not quoted, the quality of English was not judged.

REM I SAW Explicit Speech

There were 46 REM I SAW reports which contained 33 quotations with an average length of 9.8 words. Again, the pattern is like that for I HEARD reports, with all quotations being in the dream context, dream characters other than the dreamer doing most of the speaking, and the speech being like normal spoken English conversations.

REM I SAW Implicit Speech

In the 46 REM I SAW reports, 58 conversations were paraphrased, with an average length of 12 words. All but one paraphrase was relevant to

the rest of the dream, and most were in the form of conversations. The only apparent difference from the pattern described above is in who the speaker was. Here, 31 times out of the 58 paraphrases, the speaker was the dreamer.

Table 4

The Nature of Dreamt Speech

REM I HEARD Awakenings

Explicit Speech:

# reports	# quotes or paraphrases	Average # words per quote or paraphrase	In Dream Context		Speaker		Type		Quality of English	
			Yes %	No %	Dreamer %	Other %	Con* %	Mon* %	N* %	TorW* %
57	61	8.1	92	8	34	66	97	3	97	3!
Implicit Speech:										
57	79	10	97	3	28	72	90	10	--	--
REM I SAW Awakenings:										
Explicit Speech:										
46	33	9.8	100	0	27	73	88	12	100	0
Implicit Speech:										
46	58	12	98	2	53	47	97	3	--	--

* Con = Conversation; Mon = Monologue; N = Normal, T = Telegraphic; W = Written

! Sung

CHAPTER IV

DISCUSSION

Implications of the Findings

It is recalled that the memory studies considered in the Introduction (Bransford and Franks, Paivio, Luria, Seamon, Peterson) found that, while visual images and meanings were long lasting in memory, words were lost quickly. This finding is the basis for analogy to dream report data. If mental words were part of the dream experience, the subject's recall for them should be best immediately on awakening. If dream characters did not "speak" and if the dreamer did not experience mental words, but if meanings and images made up the dream experience, then the number of quoted words in dream reports would not be expected to change after a delay. The fact that scores on Explicit Speech are significantly higher on I HEARD than on I SAW awakenings (while visual imagery scales are not significantly different) allows one to infer that mental words were, indeed, a part of the dream experience.

The above comments on the form of the dream experience involving mental words are an inference about a covert process. The dream experience is not publicly observable and a subjective introspection, without corroboration, is of limited value. This study allows for reasoning, based on studies of waking memory for verbal stimuli, to supply corroboration and inferential support for subjects' statements about the dream experience.

The fact that subjects can report more quotations immediately after REM awakenings than they can after a delay is consistent with what we know about memory for words: It is short lived. The fact that descriptions of visual images do not decrease rapidly is in line with what we

know of memory for images: It is long lasting. This conformity between recall characteristics for known stimuli and the content of subjects' dream reports allows us to make inferences about the nature of the stimuli experienced by subjects druing sleep. As described in the Introduction, Mandler's cautionary remarks on the issue of recall of visual and verbal material require us to consider this interpretation of the findings suggestive of the above mentioned inferences, not conclusive.

Discussion of Specific Results

The possibility of interaction between sleep stage and awakening condition was considered and a definitive answer cannot be offered. The level of probability obtained for the interaction (over the six scales) approached significance, so it would be imprudent to risk a Type II error by asserting that there was no interaction. If the data for REM and NREM awakenings were to be lumped together, on the assumption that the sleep stage did not affect the results for I SAW and I HEARD awakenings differently (no interaction), when, in fact, sleep stage did have such an effect, then results for each awakening condition might be diluted or confused. Accordingly, the results for the two sleep stages were considered separately.

REM Awakenings

The only signficant difference between mentation reports from I SAW and I HEARD awakenings is in Explicit Speech. The only other variable which approached significance ($p \leq .10$) was visual modifiers. Subjects report significantly more quotations on I HEARD awakenings (when heard words are reported first), while there are no significant differences between I SAW and I HEARD awakenings in amount of visual

imagery reported. These findings support the other main contention of the study, that the I HEARD awakening condition is a method for obtaining a more detailed description of the dream experience than can be obtained using the typical awakening protocol.

This contention is supported by the observation that on I HEARD awakening, we got more quoted words than on I SAW awakenings, while the amount of reported visual imagery was not significantly different between the two awakening conditions. Finding such a systematic relationship between awakening procedure and report content lends support to the proposed memory process explanation for typical report content. Since the delay and distraction of the I SAW awakening condition did impair recall for dreamt words, it is not a great leap to assume that reports of dreamt words are relatively infrequent because of the typical sleep laboratory procedures (of calling the subject's name and asking questions immediately on awakening), which may be even less conducive to recall of verbal material than the I SAW condition.

The amount of Implicit Speech (paraphrased or described conversations) is higher on I HEARD than on I SAW awakenings for both REM and NREM, although the differences are not significant. This trend was not predicted, but might be explained by subjects sometimes paraphrasing rather than doing the more demanding task of quoting dreamt conversations on I HEARD awakenings. On I SAW awakenings (when visual imagery is reported first), subjects may not recall conversations well enough to give detailed paraphrases (the scoring rules were strict as to what constitutes a paraphrase -- the speaker or the listener must be specified and specific details of the communication must be reported for an Implicit Speech rating).

NREM Awakenings

On NREM awakenings, there were only marginally significant differences between I SAW and I HEARD reports. There were many no-content reports on NREM awakenings, and only 14 of 28 subjects reported any NREM dream experiences at all. This small number of subjects for which I SAW/I HEARD differences could arise might explain the lack of significant differences on Explicit Speech.

The Nature of Reported Verbal Experiences of REM Sleep

The quotations and paraphrases of reported verbal experiences from REM awakenings were counted and their quality judged by the experimenter. A report of these results is offered to supply information about the dream experience not usually included in papers on dream content. The length of both quotations and paraphrases was about the same for I HEARD and I SAW awakenings, but there was a higher proportion of quotations on I HEARD awakenings. The finding that almost all dreamt speech is relevant to other dream events will be related to views of dream formation and function later in this section.

Except for I SAW Implicit Speech, the speaker was usually not the dreamer, but the speaker was some other dream character. Speech in dreams was judged to be like normal spoken English and usually took place in the context of conversation rather than as monologue.

Obtaining More Complete Dream Reports

This study provides investigators with a method for obtaining data that was apparently being lost in previous experiments. The frequency of reported quotations is much higher in this study than in a sample of reports from 73 subjects collected in five laboratories (A3 study above).

In that study, 14 of 73 subjects reported quotations (as scored by our Psycholinguistics Coding Manual), while every subject in this study quoted mental words from his or her dream experience. For some of the reasons considered in the Introduction (salience of images, interference with subjects' verbal recall by communication with the experimenter), or for other reasons subjects tend not to report quotations first and they forget them. By using the I HEARD awakening technique, investigators can get reports of dreamt conversations and then obtain a relatively complete report on the rest of the dream experience.

Toward a Model of Dream Formation and Function

Integration of Neo-Dissociationist and Cognitive Views of Dreaming

The following comments are speculative. The models and ideas suggested here, while consistent with the findings of this dissertation, are in no way presented as conclusions supported by the data. The section is meant to stimulate thought on certain issues related to dream function and cognitive psychology, in general, but are not presented as an integral part of the experimental findings or implications of this dissertation.

This dissertation investigated the conscious experience of mental words generated by an information processing subsystem dissociated from the perceiving subsystem. The perceiver, i.e., the dreamer, is identified as self and is the perceiver of a dream fantasy plotted by a seemingly autonomous agent. The above follows the lead of Hilgard's (1977) Neo-Dissociationist Theory.

Hilgard presents the view, supported primarily by evidence from the behavior of hypnotized subjects, that:

(1) Effort and planning may take place without conscious awareness.

(2) Dreams and hallucinations are relatively autonomous productions of a system dissociated from the usual conscious controls. And

(3) the hidden control processes that regulate dreaming are not directly available to consciousness, but are known through the dream, i.e., the dream is a means by which the results or activities of unconscious information processing is made available to consciousness. Freud's (1965) comment that the dream is the royal road to the unconscious is in line with the above. Hilgard speculates that laterality of cognitive functioning is a good candidate for the substrate or correlate for divisions of consciousness. Hilgard quotes William James, "It must be admitted therefore, that in certain persons at least, the total possible consciousness may be split into parts which coexist but mutually ignore each other, and share the objects of knowledge between them .... Barring a certain common fund of information, like the command of language, etc., what the upper self knows the under self is ignorant of and vice versa" (James, 1890 in Hilgard, 1977).

The results of this paper are consistent with the view that language is, in fact, a medium of communication between the system perceiving and the system producing dreams. Since the dream experience may include words which were generated by a subsystem separate from the perceiving one, we may have a situation where one part of the mind is literally speaking to another.

Dreams have been thought of as communication to the individual from God, spirits, people not present or as information about the future or distant events. But now, the dream seems to be a production

of a system of the mind not identified as that center of consciousness which is "I". It seems that one experiences or perceives the dream much as one views a film. If dreams were not so common, we might wonder why this peculiar uncontrolled fantasy takes place. Waking fantasies are produced consciously and purposely by the individual ("self"). When this is not the case, the fantasies are called obsessions or hallucinations which are thought to be functional attempts at adaptation in individuals with some psychopathology (Page, 1971). But what is the function of the dream fantasy in normal individuals? My inclination is to see a cognitive or information processing function.

For the cognitive psychologist, dreams can be thought of as communication with the "self" from parts of the information processing apparatus whose operations are not conscious, but which provide consciousness with a dramatization or real-time (Dement and Wolpert, 1958) readout of the results of processing about events, people or problems of concern to the person. What is particularly interesting is that part of this communication is in the form of fully formed mental words and not only in the form of images or in the more abstract form of meanings or propositions.

The Formation of Dreams

The objects and events in dreams usually cohere as scenes and plots with only occasional bizarre elements (unpublished examination of A3 reports from 73 subjects). This coherence is consistent with the view that some higher level processes such as goals, problems or plans underlie the selection and arrangement of dream elements. If qualities of brightness-darkness, color or other low level sensory features were the starting point of dreams, then the processes used in perception

such as figure-ground or constancies would probably result in visual images of unrelated objects or perception of unrelated words.

Even if such activity in the sensory system does act as a stimulus, there must be higher order processes which organize the original elements into a coherent grouping of perceptions, and then must take over to provide for consistency and logical sequence in the rest of the dream experience. While the degree of logical sequence in dreams may not match that of Shakesperean plays or philosophical essays, it does seem roughly equivalent to the coherence of daydreams or other spontaneous daytime thinking.

These speculations of the steps in the construction of dreams imply something further. There appear to be two or more levels of activity under dicussion here. At one level of processing, dreams are created; a second level experiences these dreams; and sometimes, in so-called lucid dreams, a third level thinks about the experience or attempts to bring the dream forming process under conscious control.

The author, following frequent discussions of this issue with John Antrobus, and in line with Hilgard's views, often thinks in terms of communication between cerebral hemispheres which may act as partially separated centers of cognitive action and experience. In particular, one can imagine that if visual images are formed in the right hemisphere and words in the left hemisphere, then both cerebral hemispheres are involved in the dream formation process. Since dreamt words usually seem relevant to the visual aspects of the dream, we can imagine a continous exchange of information between visual and verbal systems being integrated and controlled by some higher order executive system and then, perhaps, perceived as a whole by a conscious inter-hemispheric

monitoring system.

The above speculations go far beyond present data. It is not even clear just how to operationalize concepts such as the systems and meta-systems described in the previous paragraphs. The present paper attempts a small step toward a theory of dream formation by seeking to increase our data base of dream contents, particularly of verbal experiences during sleep and suggesting, in broad outline, the steps a dream formation process might require.

Two interesting aspects of dream reports fit nicely with these ideas. Sometimes, one seems to know something about a dream character which is not supplied by or contradicts the sensory impression of the dream. An example is the subject who reports a character "was my brother but looked like a girl." A visual image produced by the right hemisphere and a verbal idea produced by the left hemisphere, being brother to, were united in consciousness by a dream generating system in violation of waking reality, i.e., such a visual stimulus would not normally arouse or be associated with the verbal element brother while the subject is awake. Another common dream experience which differs from waking experience is when scenes or actions shift abruptly. The subject often expresses surprise, saying, for instance, "and suddenly we were outdoors." Here, the nonconscious dream generating system had controlled the plot of the dream without providing a visual or verbal connection between successive elements, but possibly providing connections at a propositional level, i.e., a connection in meaning or association between elements which are not connected in waking sensory experience or waking expectations.

The Function of Dreams

It is likely that a therapist would seek to find meaning in the bizarre appearance of the dreamer's brother, or in the rapid transition in the latter example. John Antrobus (1977) provides a starting point for the application of ideas of cognitive psychology and models of dream formation to the clinical "art" of dream interpretation. In a dream reported in the Antrobus paper, one subject reports feeling let down by his friends and dreams of being in a swimming pool as all the water runs out, so he is let down to the bottom of the pool. In another dream, a retired railroad worker about to undergo surgery for vascular blockage in his leg dreams of a clogged pipe blocking a switch on a rail line. Antrobus suggests that the mental images and events in these dreams are metaphors or symbols for the true concerns of the subjects.

Mental words, mental images, emotions and perhaps other forms of experience are part of the dream. From an information processing point of view, different formats for presenting or conceiving of information result in different processing characteristics. A dramatic example of this is the Peterson (1975) study on memory for letters. When subjects were told to rehearse a string of letters verbally, their recall followed a standard pattern with a serial position effect. When subjects were told to form an image of the letters in a matrix, recall was strikingly different. There was no serial position effect, but letters in matrix corners and perimeter cells were recalled best. Length of recall was also different for visual and verbal rehearsal.

Other information processing differences based on the nature of coding exist (serial versus parallel processing, Seamon, above) and it follows that, in solving a problem, there could be advantages and dis-

advantages to each type of processing. It is possible that metaphors in dreams serve to vary the way in which something is conceived of. Being disappointed or let down is conceived of via a visual model -- falling to the bottom of an emptying pool. This way of modeling the event may allow features of the situation to be analyzed which were hard to deal with in other forms. Was the "let down" fast or slow, was it under the dreamer's control, what happens when one hits bottom? Possibly, these aspects of the situation were explored in that visual model.

Also, since it appears that the cerebral hemispheres are specialized to some degree, it may be that dreams which consist of both mental images and mental words bring the networks of associations, schemas and processing techniques of both hemispheres to bear on the subject matter of the dreams. It is conceivable that this integration is the special function of dreaming, an active equilibration and pulling together of ideas and information during a period when external stimulation and action are limited.

The suggestion is made, therefore, that dreams involve metaphors, mental words, and mental images as techniques for varying the point of view on an issue. Stated differently, the mind tries out different models of a situation and sees what can be learned from each conception of the events which follow. This is analogous in some ways to an engineer first doing calculations (a mathematical model) then producing an image on a computer controlled screen which can be viewed from different angles and under different stresses (a visual model), and then building a replica for wind tunnel or other testing. If this sort of information processing does take place in dreams, then the common

adage "sleep on it" before making important decisions is good advice. In fact, differences in performance after having slept on a problem, if they could be found with the proper controls for time and time of day, would be consistent with the above speculations on dream formation and function.

APPENDIX

A. Psycholinguistic Coding Manual

B. Polygraph Settings

APPENDIX A

After judges selected those words in the mentation report which are informative about the sleep experience (according to the Total Content Count scale) the reports were scored for visual imagery and auditory experience according to the following rules (excerpted from the Psycholinguistic Coding Manual). The scoring manual includes scored reports as training aids and a set of reports used as a test of the judge's ability to apply the manual's rules.

PSYCHOLINGUISTIC CODING MANUAL FOR REPORTS OF SLEEP

and stimulus independent waking state EXPERIENCE

Revised June 1976

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The City College of The City University of New York

We would like you to read a number of reports. These were collected from subjects in a sleep laboratory after they were awakened during the night with these words: "Subject's name, wake up" followed by "Tell me everything that was going through your mind before you were awakened."

Scales have been devised to score various qualities in these reports. The scales and subscales for scoring these qualities are:

I. Total Content Count
II. Visual Imagery
  A. Visual Nouns
  B. Visual Modifiers
  C. Visual Action
  D. Spatial Relations
III. Audition
  A. Explicit Speech
  B. Implicit Speech
IV. Other
  A. Visual-Verbal Signs
  B. Discontinuities
  C. Improbable Combinations
  D. Improbable Identities
  E. No Plot
  F. Intention
  G. Interpretative and Evaluative Judgment
  H. Non-affect
  I. Ambiguous Sensory Modalities
  J. Affect
  K. Total Word Count

Score all categories for one report before going on to the next report. Please do not begin scoring until you have read all of the instructions. Enter the score for each scale on the judges' work sheet. Please note that in the examples words to be counted are underlined.

We are interested in what the subject was experiencing before he was awakened. Descriptions of his feelings, sensations, thoughts, emotions, "actions", and visual or auditory "perceptions" inform us of his experience.

Visual Imagery

General Rules for Scoring Visual Imagery

The basic problem in scoring the mentation reports is that subjects often say they "know" something without indicating a sensory cue. For example, it is reasonable to suspect that statements of location (i.e., "I was in Texas") may not necessarily be accompanied by internal visual images. The subject just knows he was there. To be conservative when scoring the visual scales please do not classify and items as "seen" unless there is a strong direct or implied evidence of a specific sensory cue.

1. A word is to be counted if:

   a. the word clearly represents an item the subject "saw"

   or

   b. the word clearly modifies or alters visible characteristics of an item the subject "saw".

Example: "An old man walked by"

Visual Nouns	Visual Modifiers	Visual Action	Spatial Relation
man	old	walked	by

Explanation: From the above sentence it seems that the subject saw an old man walking. "Man" is a person visible to the subject. "Old" adds information about the appearance of the man. "Walked" indicates a visible action and "by" tells where the movement took place.

If the sentence were "A good man walked by" the word "Good" would not be counted because it is not clearly a visual modifier of man (see Evaluative scale). A good man might have any appearance.

If the report were "I heard an old man walk by" nothing would be counted. Hearing something does not involve visual imagery.

2. The subject often seems to know things about people, objects, or actions in the report in the absence of, or even in opposition to, visual images. Count words which tell what the subject "sees" not what he knows.

VISUAL NOUNS

1. Visual Nouns are concrete nouns naming seen persons, animals or objects. The intent here is for the number of visual nouns to equal the number of "visualized" entities.

Example: "It was in the country on a row boat fishing."

Explanation: A boat was apparently visible to the subject. The word "country" is too vague to be counted; seashore and mountains could both be a "country" and it is not clear whether either was visible (see Ambiguous Sensory Modalities scale).

2. If a visual noun is referred to more than once in a report, count it only once unless it appears in a new location or is engaged in a new action.

3. Do not count the subject himself unless it is explicitly stated that he was "seen".

Example: "I was in a car."

Explanation: "I was not counted as it is not clear that the subject saw himself rather than knew that he was inside the car. If the report were:

"Jim was in a car"

or

"We were in a car"

"Jim" and "we" should be counted as visual nouns since it is assumed that a second person was visible to the subject (unless the report goes on to say that the subject knew they were in a car without seeing anything).

4. Sometimes the indentity of an apparently visible character is ambiguous. For instance, the subject may not know if some character is a man or a woman. In such cases count only one of the possible identities as a visual noun. (See rule 5 under Visual Modifiers.)

Example: "I'm not sure if it was John or Mary who was with me"

Explanation: Choose the first possible identity mentioned by the subject.

5. If a character's identity changes during a report, count each visible identity separately.

6. The same character or characters may be referred to in several ways such as "people, friends, John and Mary." Count the form which gives the most information about the characters. That is, count "John and

Mary" rather than "friends"; and count "friends" rather than "people". Count other references which add information as Visual Modifiers.

Example: "...John and Mary who were friends..."

Example: "...the old man and he was my grandfather..."

Visual Nouns	Visual Modifiers	Visual Action	Spatial Relations
grandfather	old man	0	0

Explanation: "Grandfather" is a more informative description that "old man", but "old man" does add information about the grandfather's appearance since some grandfathers aren't old. Therefore count "old man" as a single visual modifier.

7. Discussions between characters about people or objects should not be counted unless the items are apparently being "seen" by the characters.

8. Very general terms such as "everything or something" are not scored. "Someone or everyone" should be counted if this is the best description available.

VISUAL MODIFIERS

1. A visual modifier must alter the visual image suggested by the word scored in Visual Nouns. This modification should not suggest movement of the object or person as such movement would be scored as Visual Action (below).

Example: "It was in the country on a row boat fishing"

Explanation: The word "row" modifies and gives more information about the appearance of the visual noun "boat". It is not any kind of a boat, it is a row boat. Visual modifiers may be adjectives, nouns or verbs.

2. Numbers or quanitification are also scored here. If, however, all the items are separately named and counted as visual nouns do not count a number as a visual modifier.

Example: "Two friends passed"

Visual Nouns	Visual Modifiers	Visual Action	Spatial Relation
friends	two	passed	0

But if the sentence were:

"Two friends, John and Mary passed"

then score as follows:

Visual Nouns	Visual Modifiers	Visual Action	Spatial Relation
John Mary	0	passed	0

3. Negation and absence of stimuli: if a report is "The bike had no wheels or The man had no clothes" score "no wheels" and "no clothes" as visual modifiers since they describe the appearance of a Visual Noun (man).

4. Analogies, Simile, Metaphor: Count all words in the analogy or metaphor which modify or alter the noun-image. Do not count redundant terms.

Example: "...a building I have the association jail with the building ...the way constructed is like...if you take a can like a pop or beer can and cut it in half and put the half down with the curved roof...it was sort of like an old farm building."

	building		
Modifiers (8 in all)	farm	roof	can
	old	curved	pop
			half
			down

Explanation: Don't count "beer" as it is redundant with "pop". Further, don't count "take and put" since these verbs describe elements that are not part of the visual image. "Cut" on the other hand, is considered as a modifier.

5. In examples such as "I saw my brother but he looked like a girl" score "brother" as a visual noun and "girl" as a visual modifier. (See rule 4 under visual nouns.)

VISUAL ACTION

1. Words which describe movement or action which was visible to the subject are counted here. These are usually verbs or adverbs.

Example: "It was in the country on a row boat fishing"

Explanation: "Fishing" is an action involving movement which was apparently visible to the subject.

2. Since a verb may relate to more than one concrete noun, and each visual noun is listed on a separate row, the verb may be listed on either row, but not on both.

3. If two or more verbs mean approximately the same action took place then count the first one only.

Example: "They peeked and looked around the corner"

Visual Nouns	Visual Modifiers	Visual Action	Spatial Relation
they corner	0	peeked	around

Explanation: "They" is a pronoun representing people apparently visible to the subject. "Peeked and looked" are verbs describing the same action so only the first is counted. A "corner" is visible in the scene and "around" modifies the location of where the peeking took place in relation to the corner.

4. Compound verbs such as "started to look" or "going to come" are scored as one item in visual action.

5. Abstract terms, i.e., "I saw lots of action." "Action" may be counted as a visual action and "lots" as a visual modifier even though the specific elements of the action are not stated.

SPATIAL RELATIONS

1. Words such as "over, under, on, in" which define visual relationships in space are counted in this category. (Prepositions or adverbs.)

Example: "He walked in the room"

Visual Nouns	Visual Modifiers	Visual Action	Spatial Relations
He room	0	walked	in

Explanation: "In" is a word adding information about where the person walked in relation to the room. He didn't walk past or over the room, but in it. In this example the location "room" is fairly specific. Where the location or object is so vague that no particular visual image is suggested neither the location (noun) nor the preposition (spatial relation) should be counted.

Example: "I saw John walking in England"

Visual Nouns	Visual Modifiers	Visual Action	Spatial Relations
John	0	walking	0

Example: "It was in the country on a row boat fishing"

Explanation: The action was taking place "on" the boat not over it or under it. The word "in" in the phrase "in the country" is not counted because it is vague and doesn't suggest any particular visual image. (See Ambiguous Sensory Modalities Scale.)

AUDITORY: EXPLICIT SPEECH

Explicit speech occurs when there is direct quotation of speech, book titles or words from songs in the report. All words occurring in the direct quote (not paraphrased) will be counted.

IF Direct quotation is indicated by the presence of a verb indicating speech such as said, told, reported, etc.

AND Reference is made to either the one producing the speech or the one spoken to.

AND The statement is a direct quotation of what is said (even though it is not enclosed by quotation marks).

THEN Count all words within the direct quote.

Examples: "John said inflate the ball and throw me the bat" Total = 8

"I said keep the book" Total = 3

"Eat the apple he retorted" Total = 3

After identifying a direct quotation write down the words to be counted and the total. If the phrase is three words or longer, write down only the first and last words.

AUDITORY: IMPLICIT SPEECH

Implicit speech occurs when words, verses from songs, sentences or conversations are not quoted but paraphrased in a report. All words contained in the paraphrased statement will be counted subject to the general rules for redundancy, comments, etc. in total content count.

IF There is a verb related to the process of saying or hearing

AND There is a reference to either the one speaking or the one spoken to or both

THEN The count would include all words contained in the paraphrase, and not the words used to describe the communication.

Examples: "We were talking to Homer about the new electronics and how equipment is getting smaller nowadays" Total = 9

"John talked about the candles and how they were made" Total = 7

"The teacher lectured on the algebra concepts in physical sciences" Total = 6

Write down all the words included in the count as well as the total. If the phrase is three words or longer write down only the first and last words.

APPENDIX B

Polygraph Settings

Listed below are the polygraph settings tradtionally used in The City College Sleep laboratory for recording human bio-potentials.

	EOG	Bipolar EOG	EMG	EEG
Time Constant	.3RC	1 RC	.03 RC	.3 RC
High Frequency	3	3	1	3
Pre-Amp	.5	.5	.5	.5
Amplifier	.1	.1	.1	.1
Filter	Hi-out	Hi-out	Hi-in	Hi-out

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