

Patterns of Sleep Talking

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In recent years, the work of Aserinsky, Dement, Kleitman, and others¹⁻⁵ has stimulated research on the relationship of electroencephalographic (EEG) and eye-movement patterns to dreaming. This type of research usually involves continuous monitoring of the EEG's of sleeping subjects. In those laboratories where the use of an intercom system has permitted simultaneous sound monitoring of subjects' sleeping rooms, investigators have had the opportunity to hear subjects talking in their sleep. This paper reports our observations of sleep talking and its relationship to EEG patterns, dreaming, and other variables.

Since our findings will be discussed in the context of the recent EEG-dream research, a brief introduction to this area is indicated. In one of their reports, Dement and Kleitman defined 4 EEG stages of sleep: Stage 1—low voltage, random activity; Stage 2—spindling and K complexes against a low-voltage background; Stage 3—spindling and K complexes against a background of δ -waves (greater than $100\mu V$, and slower than 2 cps) where the δ -activity constitutes between 10% and 50% of the record; Stage 4— δ -activity constituting 50% or more of the record. Rapid eye movements occur almost exclusively during Stage 1. The concurrent appearances of Stage 1 low-voltage random activity and rapid eye movements have been designated REM (rapid eye movement) periods, while Stages 2, 3, and 4 have been designated NREM (*no* rapid eye movement) periods.

Early investigations in the EEG-dream area suggested that dreaming occurs exclusively, or almost exclusively, during REM periods.¹⁻³ More recently, several investigators have obtained greater recall of mental content after awakenings from NREM periods than earlier workers had obtained.^{6,7,9,10}

Submitted for publication Jan. 15, 1962.

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This investigation was supported by Grants No. M-4151 and No. M-3885 from the National Institute of Mental Health, U.S. Public Health Service.

However, every reported investigation in this area discloses more dream recall from REM periods than from NREM periods.¹⁻¹⁰ Also, NREM reports tend to be qualitatively less dream-like and more thought-like than REM reports.^{6,10} Therefore, using recall of mental content as the criterion of dreaming, there is a definite, although not perfect, association between dreaming and REM periods.

Kamiya⁹ has made the following observations on sleep talking in the course of his EEG-dream research: (1) Sleep talking usually accompanies body movements. (2) Most of the body movement-vocalization combinations occur during NREM periods rather than during REM periods. (3) Sleep talking is probably "not accompanied by the experience of dreaming. In cases where reports of dreaming are given following the vocalization, the two are not related in content."

The present report combines observations of sleep talking originally made independently in 2 different sleep laboratories. In neither laboratory was a specific experiment designed to study sleep talking. However, in the course of monitoring approximately 600 subject-nights of sleep, distributed over a number of different experiments and subjects, a sufficient number of spontaneous vocalizations were observed to warrant some generalizations.

It will become apparent in subsequent discussion that different sets of criteria could be used to define sleep talking. For purposes of our initial selection of "sleep talking incidents," the following criteria were employed: (1) Vocal sounds coming from the subject had to be recognized by the experimenter as speech. It was not necessary that the experimenter be able to discern the specific words said by the subject. Occasionally it was apparent that the subject had vocalized words, but either poor enunciation or low voice intensity made specific words undiscernible, or the experimenter was so unprepared to hear the subject speak that he did not recognize what was said. Nonverbal vocalizations judged by the experimenter to be moans, groans, coughs, sneezes, or snoring rather

than speech, were not included as sleep-talking incidents. (2) The EEG record preceding the vocalization had to be clearly classifiable into 1 of the 4 EEG stages of sleep. Verbalizations during or immediately following Stage 1 periods that occurred while the subject was falling asleep were not included as sleep-talking incidents, since other evidence¹¹ indicates that "descending" Stage 1 periods represent transition periods between wakefulness and the conditions generally accepted as sleep. All the Stage 1 periods from which sleep-talking incidents were taken were "emergent" periods in the sense that they were preceded by spindling and/or δ -activity and showed clear evidence of rapid eye-movement activity. (3) The verbalization had to be outside the context of the immediate social situation. This criterion assumed importance in instances where the EEG record at the movement of verbalization was obscured by muscle tension artifact, and where, by EEG and unambiguous behavioral criteria the subject was clearly awake after having spoken. For example, had the subject said, "I just had a dream," and then proceeded to give a long, detailed narrative report, the quoted phrase would not be counted as a sleep-talking incident. Had the subject said, "and that's what I was doing," followed by "did you wake me; do you want a dream report," then the phrase "and that's what I was doing," would be counted as a sleep talking incident, since this phrase is clearly not one with which a fully awake subject would begin a report to an experimenter. (4) Where subjects spoke 2 or more phrases in succession, the phrases were counted as separate sleep-talking incidents only when there was an intervening period of a sleeping EEG pattern which was free of muscle tension artifacts. In practice, these criteria could be readily applied.

The data of this study are based upon 84 sleep-talking incidents collected from 28 subjects. Fourteen of these incidents were followed by an awakening and an interview designed to elicit a report of mental content during the incident and to explore the subject's awareness of the sleep vocalization.

Of the 84 sleep-talking incidents, 7 (8%) occurred in REM periods, 53 (63%) occurred in Stage 2, and 24 (29%) in Stages 3 and 4. Sixteen subjects contributed 1 incident each to the series, in contrast to the 12 subjects who contributed from 2 to 18 each. Therefore the possibility that the distribution among stages was unduly influenced by data from a few subjects was investigated by recalculating on the basis of 1 incident selected at random from each subject. This calculation reduced the number of incidents to 28, of which 4 (14%) were in REM periods, 12 (43%) were in Stage 2, and 12 (43%) were in Stages 3 and 4.

These data on the relationship between sleep talking and EEG stage are entirely consistent with the findings of Kamiya.⁹ Clearly, sleep talking occurs in NREM as well as in REM periods. In fact, sleep talking occurs no more often, and may occur less often during REM periods than might be expected on the basis of relative time spent in REM sleep. Unpublished data of 80 nights of uninterrupted sleep from one of our laboratories (using EEG scoring systems, sleeping conditions, and college student subjects similar to those on which the bulk of the sleep talking data is based) indicate that about 20%-25% of 6 to 8 hours of natural sleep is spent in REM periods. In contrast, only 14% of the sleep-talking incidents in our sample occurred during REM periods.

A prominent feature of the EEG records of sleep-talking incidents which occurred during NREM periods is the frequent occurrence of associated gross muscle tension artifacts. These data are consistent with the findings of Kamiya. Gross artifacts do not occur when an awake subject talks unless there are also gross behavioral manifestations of muscle tension such as straining, grimacing, or turning over.

In contrast with the regular occurrence of muscle artifact in NREM sleep-talking incidents, 5 of the 7 REM period incidents had no muscle artifact, and 2 had minimal artifacts, mostly confined to the anterior temporal (eye) or facial leads. The artifacts during REM period incidents appeared to

result from activity of facial muscles associated with talking, rather than from a more generalized body tension. In 2 REM incidents, tension on leads from the subject's lip or larynx clearly marked the interval during which speech occurred, but there was no marked muscle artifact in the EEG records during these intervals. In all instances where subjects were not awakened following REM incidents, the EEG record continued after speech without noticeable change. Of 53 incidents in Stage 2, 52 had major and 1 had minimal tension artifacts, and of 24 incidents in Stages 3 and 4, all had major artifacts. Kamiya's data also show a tendency for NREM speech to be accompanied by more gross muscle artifact than REM speech, although the trend was not so clear as in our data.

Four of the REM incidents occurred in subjects who also produced NREM incidents. In each of these subjects, gross muscle artifacts accompanied the NREM incidents, while REM incidents showed little or no artifact. Therefore, it appears that the differential appearance of gross muscle tension artifact in sleep talking incidents during REM and NREM periods does not result from a confounding of subjects and stages.

The typical appearance of the EEG record at the time of sleep talking during NREM periods was as follows: After varying periods in Stages 2, 3, or 4, there would be a sudden eruption of muscle tension artifact on all leads, and the speech would occur during this tension. Occasionally, a brief flurry of high-voltage slow waves or prominent K complexes preceded the muscle tension by a few seconds. This suggests that the sleep talking and associated muscle tension may be the concomitants of a process which has earlier manifestations in cephalic changes. Most often, the tension artifact obscured the EEG patterns during speech. However, when cephalic activity was discernible through the tension artifact, it generally proved to be in the 7-10 cps range; judging from its special prominence on occipital leads, it seemed to be α -rhythm. In a few instances, large slow waves seemed interspersed with the muscle

tension, but it was not clear whether these formations were artifactual or cephalic in origin. There is also a possibility that rapid spiking discharges of cephalic origin may have accompanied the muscle tension and vocalizations in some cases, but again the recordings were too unclear at these points to make any judgment on this matter with confidence.

Typically, the tension artifact would persist for a brief period following the speech, perhaps for 10 or 20 seconds. Then the tension would subside rapidly, but not abruptly, and the EEG record would become intelligible again. Usually, the post-tension EEG was either a low voltage random pattern progressing to a Stage 2 within 60 seconds, or Stage 2 appearing immediately following the tension. The usual postspeech EEG pattern was Stage 2, even where the subject had been in Stage 3 or 4 prior to speaking. NREM sleep talking never initiated REM periods. A notable feature of the postspeech EEG was that it was not usually characterized by the extended trains of α -activity often seen following body movements during nonspeech sleep and almost always seen when a subject awakes from sleep with a body movement. On a few occasions, however, the tension period progressed to an unambiguous waking state.

The distribution of sleep-talking incidents by time of night was studied by randomly selecting a single incident for each subject, thus eliminating a possible confounding between subjects and time of night in the analysis. Briefly, the results indicated a roughly linear distribution of sleep talking throughout the night. The chance that sleep talking would occur during any one particular hour of sleep was about as great as the chance that it would occur during any other hour. Similarly, there seemed to be no prominent patterning of sleep-talking incidents among different nights for the same subject. Where subjects had spent more than one night in the laboratory and had produced more than one sleep-talking incident in the course of their laboratory experience, there was no significant tendency for sleep-talking

incidents to cluster in particular nights to the exclusion of others. Whenever a subject had 2 or more sleep-talking incidents in a night, the content of the sleep talking was investigated to determine whether the incidents within a night were related. In general, the content of the speech was so meager that no definitive conclusion could be reached on this point. There were 3 different nights from 3 different subjects in which the speech content of at least 2 incidents were related to the immediate experimental situation. This finding is not surprising, however, in view of the large number of sleep-talking incidents which are generally related to the experiment.

In some of the sleep-talking incidents the words spoken could not be recognized; still, many incidents of articulate speech were recorded. The vocalizations ranged in length from a single word or phrase to a sentence or more. The longest incident was 18 words in length. The following examples illustrate the variety in the records obtained: "OK"; "That was that"; "Something's wrong"; "You know I had a hard time getting to sleep last night"; "Um, I'd say it was moderately poor"; "I don't remember what I was reaching for. I remember dimly."

In none of the incidents did it appear that personal secrets were being revealed in the content of the sleep talking or that the content of the speech was such that the subject would have felt embarrassed had he spoken the words aloud while awake.

Many of the longer speeches seemed to refer to the experimental situation itself, as if the subject were answering standard questions asked by the experimenter in the various experimental protocols. For example, one subject said "It suddenly refers somehow to dream number one." In some cases the subject appeared to be reporting the content of a dream to the experimenter, as he would do if awakened. Of 32 speeches which were long enough to classify either as clearly related or as not obviously related to the experiment, half were judged to be of each type.

Each of the 3 REM speeches which were long and intelligible enough in content to

classify appeared not to be directly related to the experimental situation. Although there have been too few observations on this point to warrant any conclusion, a more thoroughly documented difference of this sort between REM and NREM speech content would be useful in an attempt to understand the nature of NREM cognitive functioning.

We also had the impression that there was more affect in the subjects' voices during the REM speeches in contrast to the usually flat, unemotional NREM statements. The REM speeches appeared to be associated with anxiety dreams as judged by the sleep-talking content and by the subject's report of the dream experience. Here again, the data are too meager to do more than suggest possibilities for future observation.

Only 2 awakenings were made following REM sleep-talking incidents. Both REM awakenings produced detailed reports of "disturbing" dreams. In one instance, the content of the sleep talk was too nondescript to permit a comparison with the recalled dream content. In the other instance, where there had been a lengthy, articulate sleep vocalization, the correspondence between vocalization and subsequent recall was good in contrast to NREM observations. The following is a verbatim transcript of this REM incident, from a middle-aged woman who complained about disturbing sleep-talking and sleep-walking episodes in her sleep at home:

E heard *S* say, "Take it off. Let me do it myself. I could do it myself."

Upon awakening a few moments after the sleep-talking episode, the following interview was conducted.

S: "Gee, what a dream. I had a date. It seems like I was a boy in the dream—or was I? No, I couldn't have been because someone was putting make-up on me—lipstick and doing my eyebrows. And I didn't like it. I thought it looked awful and wanted to take it off and they wouldn't let me and I was mad. My mother was there. I wanted to take it off and put it back myself. They wouldn't let me, I guess. That's all I remember."

E: "Did you say anything to them—remember any conversation?"

S: "Yes. That's why I said it was a peculiar dream—because I was a girl in the dream, and yet it seemed like after all they should let me take it off because of all the experience and it was my

date. I dreamt that I (several unintelligible words) with somebody, but why?"

E: "You wanted to put the make-up on yourself and someone else was doing it?"

S: "Someone else put it on and they made me look like a clown—lipstick on my eyebrows instead of eyebrow pencil."

Although only 2 awakenings were made following REM incidents, and although the above REM incident was the only one which permitted a comparison of vocalization and recall, it is noteworthy that none of the NREM awakenings produced such vivid recall or such good correspondence between recalled content and the content of the sleep talking. This observation, in conjunction with the fact that REM recall is usually much better than NREM recall in the absence of sleep talking, suggests the hypothesis that recall is much more closely associated with EEG stage than with sleep talking.

Twelve awakenings were made following NREM sleep-talking incidents for purposes of obtaining subjects' reports of psychological activity just prior to awakening. In 9 of the 12 awakenings, the subject recalled at least some specific cognitive content which he believed had occurred just before the awakening stimulus. As has been found in studies of mental activity during sleep which did not involve sleep talking,^{6,10} the content of the NREM reports was usually sparse and vague, often referring explicitly to the experimental situation. In most of these cases, the subject reported he had been thinking rather than dreaming.

In none of the NREM awakenings could the subject report the specific content of the sleep speech, although a relationship between the content of the verbal report and the sleep speech could be inferred in 7 of the 9 NREM incidents where there was some recall of content. In most of these congruent incidents, both the sleep speech and the reported mental activity referred in some way to the experiment. One example of this type of congruence is the following: In one NREM incident, a subject was heard to say, "It suddenly refers somehow to dream number one." An awakening 2 minutes later produced the report, "I'm quite sure that somehow I dreamt something,

but I somehow can't recall a single thing. It may have been a conceptual dream. I think, if I remember correctly, I had been thinking about the general experimental situation here—the laboratory."

The following examples suggest that occasionally the correspondence between NREM sleep talk content and the subsequent report is more specific than a general reference of both to the immediate experimental situation:

During one NREM incident a graduate student subject was heard to say, "If I knew what I was doing . . . (some unintelligible words) . . . perfect." An awakening 3 minutes later produced the following report: "The last thing I remember before the buzzer was talking to somebody about an experiment. I can't remember anything else." Three hours later, at the end of the night's sleep, the subject was asked in the course of general conversation whether the phrase "If I knew what I was doing," brought anything to mind. Without further questioning, the subject answered that the phrase had run through his mind the previous day in connection with a lecture he attended. A researcher reported the results of a well-designed experiment which yielded good results. The subject, somewhat envious and self-chastising, had thought to himself that if he knew what he was doing he would be able to produce an experiment like that.

Another subject said during an NREM incident, "Um, I'd say it was moderately poor; don't remember what I was reaching for, I remember dimly." During the subsequent awakening 3 minutes later, the subject gave a garbled, incoherent report, which was typical for this subject on NREM awakenings. However, the report did begin with the phrase, "There was something with this left hand."

In some instances there was a lack of obvious congruence between the manifest content of the NREM sleep speech and the subsequent waking report. This is illustrated by the following examples:

During an NREM incident a subject was heard to say "I don't think it'll hurt too

much." His report upon being awakened 1 minute later was: "I've just been putting things together, I suppose in a kind of semi-poetical or musical fashion—some ideas I was thinking of. Just before I came over here I was thinking of writing a poem for Valentine to give to someone, but I had forgotten to do it early enough, so I didn't get it done. I sort of feel in that sort of mood now." After the subject gave the above report, he was asked to associate to the phrase, "I don't think it'll hurt too much." His response was "Nothing contemporary—brings back a few childhood memories. Only thing I did think of was the time I had my last operation—when I was about 11 years old—had an eye operation. When I got wheeled into the operation room I was very interested in the ether tray apparatus, when suddenly this mask comes over my nose and mouth, and they say something like, 'Oh, this won't hurt you very much, it's okay.' And actually it didn't hurt very much, but I didn't like the idea of it being so much of a surprise, and I kept saying, 'Take it off; let's do it over again.'"

Another subject said during an NREM incident, "Am I dreaming?" This vocalization was followed by a 40-second period during which the EEG record was mostly obscured by low-voltage tension but did contain suggestions of K complexes and sleep spindles. Then there was a burst of major tension lasting 50 seconds, during which the subject said something that sounded like, "Color perry boy is more effective than color perry two." This was followed by 45 seconds of low-voltage tension, again containing suggestions of K complexes and sleep spindles, after which the subject awoke spontaneously and gave the following report: "I think I was just thinking about those alpha particles." (The subject was a physics student who occasionally gave reports of having been thinking about physics problems during NREM periods.) "I think they were supposedly a half a wave length different from each other somehow. I think they're supposed to cancel, and I was thinking about this process, I guess; I'm not sure. And then the thought hit me, you know, I was supposed to be

awake. And so I woke up and asked you if I was supposed to be recalling this or what, because I think I was really dreaming or asleep again, kind of, or going back into it. Didn't recall how I woke up." Following this report, the experimenter asked "Can you tell me what the words 'color perry' mean?" The subject responded in amazement, "My heavens! I was dreaming about fencing too. . . . Did I say counter parry?" The experimenter indicated that the subject had said something during her sleep. The subject continued: "Oh, gee whiz! I don't recall, but it's very clear that I must have been doing something about fencing. . . . I think I said two things . . . one thing and immediately something else . . . sort of one topic, one paragraph . . . that was pretty far back. . . . I bet you I was dreaming about fencing, and somehow I switched to alpha particles again. . . . Say, when I was dreaming about fencing, did I say 'counter parry one, counter parry two'? . . . No, no! Couldn't have been that! Are you sure I said something about fencing and not something about these alpha particles or something else?"

The conventional assumption that sleep talking echoes concurrent dream experiences seldom has been challenged. Our observations of sleep talking and associated EEG patterns indicate that sleep-talking phenomena have a complexity which requires more detailed consideration.

By any of the usual criteria, one would say that subjects are dreaming while speaking during REM periods. All of the recent data on the relationship between dreaming and REM periods indicate that dreams occur during these periods. There is nothing to suggest that subjects were awake while speaking during REM periods. The EEG record does not change in character, and the nature of the speech is not what would be expected from a subject who awoke and started speaking over an intercom to an experimenter. We have only one awakening following REM period sleep talking which could be used to evaluate the correspondence between the content of the sleep talking and the subsequent waking report; the data of this awakening

indicated that the sleep talking was congruent with the subject's dream experience as she recalled it.

The relationship between sleep talking and dreaming is not so consistent for the NREM incidents. In the first place, the evidence that subjects were fully asleep is less definite than in the REM sleep-talking incidents. In favor of the hypothesis that the subjects were in some kind of sleep state during NREM speech are the following observations: (1) Although much of the NREM speech dealt with the experimental situation, none of it was appropriate to the immediate social context in the sense that it was not the kind of communication that would be expected from a fully awake subject. (2) The subjects' inability to recall the speech when questioned immediately after the incidents also suggests a marked deviation from the ordinary waking state. (3) In most cases, the subject's impression was that he had been asleep immediately before the waking stimulus. (4) The EEG pattern immediately preceding the incident and, in most cases, shortly following the incident, was of the type that is conventionally described as a sleep record. Thus, by any of these 4 criteria, the subjects could not be considered "fully awake" during NREM sleep talking.

On the other hand, the NREM sleep talking incidents do not fit the "ideal" criteria for "fully asleep." These incidents were always, or nearly always, accompanied by gross body movements. It is clear that the muscles involved in speech are not, in themselves, responsible for the gross muscle artifacts. In attempting to account for the movement-speech relationship, it seems reasonable to postulate that both events result from an underlying change in the state of the organism. The EEG records obtained during the NREM sleep-talking incidents tend to confirm this view and suggest that the direction of the change may be toward a state of "arousal." The muscle artifacts make it impossible to interpret most of the EEG records at the moment of speech, but in some of the cases where part of the record could be read, α -activity appeared. We have no clear evi-

dence in any record that Stage 2, 3, or 4 persisted throughout a speech incident.

The view that at least some NREM incidents are accompanied by a form of arousal is also suggested by skin resistance data provided for us by Paul Verdone of the University of Chicago. Of 11 NREM incidents he observed, 5 were accompanied by sudden decreases in skin resistance atypical for randomly selected intervals during sleep. The 6 instances in which skin resistance failed to decrease do not necessarily mean that no arousal was involved, since occasionally subjects may be fully awakened from sleep (to the extent that they carry on prolonged conversations with the experimenter) without showing any noticeable decrease in skin resistance.

In sum, although the NREM incidents are clearly not taken from periods when the subject is fully awake, the records during these incidents differ in some respects from unambiguous sleep. Ordinarily, there is little difficulty in reaching agreement on a set of criteria to differentiate sleep and wakefulness. However, there are some borderland states which fall in the sleep category by some of these differentiating criteria and in the awake category by others. Examples of such borderland states include the transition period of "falling asleep" which precedes unambiguous sleep, sleep walking, the sleep paralysis of narcoleptics, hypnagogic and hypnopompic phenomena, and the momentary lapses of attention we all experience during the day. By most conventional criteria, NREM speech would be assigned to the sleep category. However, those features which suggest some form of arousal during NREM speech also suggest description of NREM incidents as borderland states. It may prove most productive to give full attention to all the observable characteristics of phenomena like sleep talking, because too much data could be neglected by forcing premature assignment to larger categories like sleep and wakefulness.

If, as we have suggested, some form of arousal becomes manifest in gross muscle activity during NREM speech, we are faced

with the question of why such manifestations are absent during REM speech. We can only speculate that during REM periods the gross muscle discharge accompaniment of sleep talking is actively inhibited by the intervention of pontine centers which Jouvet⁸ has shown to be crucial to this phase of sleep in cats. This interpretation, however, does not account for the fact that gross body movements which are not associated with sleep talking occur with more than negligible frequency during REM periods.

Apart from the question of whether NREM incidents occurred during sleep is the question of whether the NREM speech was accompanied by dream experiences. Although subjects reported that something was "going on" just prior to most of the NREM awakenings, often they could not report more than a vague impression of the subject of their experiences. Furthermore, these experiences were most often labeled "thinking," and they were more frequently concerned with the contemporary situation than were REM experiences. (In these characteristics, NREM reports which follow sleep talking do not differ from NREM reports without sleep talking.) Thus, if we accept the NREM waking report of mental activity as representative of the mental activity that was actually occurring during the incident, we would describe these mental experiences as less "dreamlike" than the REM experiences.

The content of the NREM speech differs from REM speech content along a dimension which also differentiates NREM and REM waking reports, i.e., amount of reference to the immediate experimental situation. This observation suggests that waking reports following sleep talking are, to some extent, representative of the subjects' mentation during sleep talking. This position is also supported by instances where there is a specific correspondence between the speech content and the subsequent waking report.

We still have not explained the instances where there is no correspondence between NREM speech content and waking report. Whether the lack of correspondence is due to incomplete recall or confabulation of the

content of mental activity during NREM sleep, or to dissociation of the vocal mechanism from the NREM cognitive process remains to be determined.

Summary and Conclusions

1. Eighty-four incidents of sleep talking which occurred during EEG monitoring of sleep in 2 different laboratories have been analyzed in this report.

2. The distribution of sleep-talking incidents by time of night does not differ significantly from a random distribution.

3. Sleep talking occurs both in REM (rapid eye movement) and NREM (no rapid eye movement) stages of sleep.

4. Sleep-talking incidents occurring during REM periods were different in character from those occurring in NREM periods, although the sample is still too small to be conclusive. (a) Sleep talking in REM periods occurred without major muscle artifact in EEG records. It was expressed with more affect in the voice. Its content was unrelated to the experimental situation, but appropriate to the recalled dream in one instance when such a report was available. (b) Sleep talking in NREM periods nearly always occurred during a major muscle artifact in the EEG record. It usually was expressed without affect, and its content tended to be related to the experimental situation. Little mental content was recalled on awakenings following NREM sleep talking. In some instances there was a correspondence between this recalled mental content and the content of the sleep talking, while in other instances there was no correspondence between the two.

5. Sleep talking in NREM periods occurs in a physiological state which temporarily interrupts sleep but is not a state of ordinary wakefulness.

6. The complexity of the physiological and semantic problems involved in the study of sleep and dreaming has been discussed and reemphasized.

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