learning-to-learn effects in children based on conceptual relations, it is difficult to decide whether such cognitive-memorial abilities actually do not exist for the age levels tested or whether, in the situations tested heretofore, there may be a production deficiency (e.g., Flavell, Beach, & Chinsky, 1966), particularly if improvements in recall are not necessarily dependent upon clustering abilities.

REFERENCES

BOUSFIELD, A. K., & BOUSFIELD, W. A. Measurement of clustering and of sequential constancies in repeated free recall. Psychological Reports, 1966, 19, 935-942.

FLAVELL, J. H., BEACH, D. H., & CHINSKY, J. M. Spontaneous verbal rehearsal in a memory task as a function of age. Child Development, 1966, 37, 283-299.

MOELY, B. E., OLSON, F. A., HALWES, T. G., & FLAVELL, J. H. Production deficiency in young children's clustered recall. Developmental Psychology, 1969, 1, 26-34.

MOELY, B. E., & SHAPIRO, S. I. Free recall and clustering at four age levels: Effects of learning to learn and presentation method. Developmental Psychology, 1971, 3, in press.

PUFF, C. R. Role of clustering in free recall. Journal of Experimental Psychology, 1970, 86, 384-386.

SHAPIRO, S. I., & BELL, J. A. Subjective organization and free recall: Performance of high, moderate, and low organizers. Psychonomic Science, 1970, 21, 71-73.

YOSHIMURA, E. K. The role of age, list type, presentation order and practice upon children's free recall learning. Unpublished Master's thesis, University of Hawaii, 1970.

NOTE

1. The triads comprising the catategorized lists were: List 1—dog, cat, cow; hand, foot, ear; bed, table, chair; drum, guitar, horn; List 2—elephant, giraffe, lion; jacket, skirt, dress; ball, wagon, blocks; shovel, hammer, ladder; List 3—sun, moon, star; car, train, truck; girl, boy, lady; knife, fork, spoon; List 4—soap, towel, toothbrush; house, barn, castle; flower, tree, grass; pen, pencil, crayons; List 5—butterfly, ant, bee; corn, potato, carrot; book, newspaper, sign; plate, bowl, cup; List 6—apple, pear, orange; broom, vacuum cleaner, rake; window, stairs, door; shoe, sock, sandal; List 7—basket, pail, bottle; clock, lamp, fan; pie, candy bar, ice cream; mountain, ocean, city; List 8—goose, owl, eagle; fish, whale, seal; mirror, comb, brush; padlock, key, chain; List 9—swing, seesaw, slide; ship, raft, sailboat; ring, wristwatch, earring; stove, refrigerator, sink.

Covert oral behavior during conversational and visual dreams*

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Previous findings of heightened covert oral behavior during linguistic activities suggested that increases in covert oral behavior might also occur during conversational dreams. It was found that covert oral behavior (lip and chin electromyograms) was significantly higher during rapid eye movement (REM) periods in which there were conversational dreams than during nonrapid eye movement (NREM) periods. On the other hand, REM periods for the visual dreams showed only minor and nonsignificant changes in covert oral behavior, relative to the NREM periods. Little change occurred for neck responses, suggesting that behavioral changes were localized in the speech region. These findings are thus consistent with those obtained from waking Ss—covert oral behavior may serve a linguistic function during dreams too.

Heightened covert oral behavior, as measured by electromyograms (EMG) from speech muscles, occurs during the performance of a wide variety of linguistic activities (auditory hallucinations, silent reading, writing, thinking, etc.), indicating that the covert oral response may function to facilitate internal information processing (McGuigan, 1970). An extension of these findings suggests that covert oral behavior should also be apparent during dreams which involve language. It was, therefore, predicted that there would be a noticeable increase in amplitude of covert oral behavior during conversational dreams but not visual (nonlinguistic) dreams.

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METHOD

The Ss were four female undergraduates at Hollins College. Each slept in the laboratory for 4 consecutive nights and was paid $5.00 a night. The S and apparatus rooms contained effective shielding for extraneous signals. EMGs were continuously recorded during sleep from the chin, lips, and neck, as were frontal electroencephalograms (EEG), and eye movements from the external canthi, all recorded on a seven-track data tape recorder. The signals were visually monitored by oscilloscopes throughout each night, and S was awakened after each rapid eye movement (REM) period. At that time S's dream report was recorded on an audio tape recorder, and S gave a clarity rating of the dream using the method of Roffwarg, Dement, & Muzio (1962). Those dreams that received S's highest clarity rating (viz, 3) were later classified for type of content; for this, three independent judges used a 5-point scale that ranged from "primarily visual content" to "primarily conversational content." Dreams judged by all three raters to be "primarily visual" or "mostly visual" were classified as "visual dreams," while those dreams which were unanimously judged to be "primarily conversational" or "mostly conversational" were classified as "conversational dreams." Recorded data were analyzed for these REM periods; "nonrapid eye movement" (NREM) comparison data were selected for an equal period of time from a point terminating 5 min prior to the onset of each REM period.

RESULTS

A total of 25 dreams received the high clarity rating. Thirteen of these met the independent rater criteria: eight were classified as visual and five as conversational dreams. All psychophysiological signals were integrated, digitized, and amplitudes were printed out for each REM period and for each preceding NREM period (for details, see McGuigan, 1967). Mean amplitudes for each REM and corresponding NREM period were then computed for each measure, and the latter was subtracted from the former. A mean response increase from the NREM to the REM periods was then computed for each S's visual and conversational dreams. Group means of the NREM and REM periods and their differences are presented in Table 1. It can be seen that both of the covert oral measures significantly increased from the NREM to the REM periods during conversational dreams (A = .282 and A = .307 for lip and chin EMG, respectively). In contrast, during visual dreams the differences for lip and chin EMG were minor and nonsignificant. The increases in lip and chin EMG during conversational dreams are noticeably larger than during visual dreams, but the differences in this case only approach

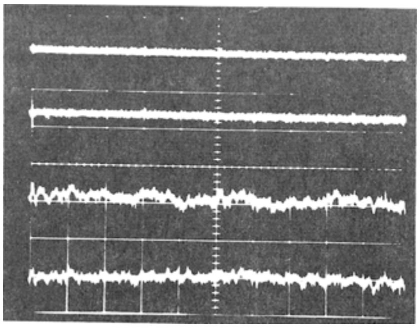

Fig. 1. Illustration of signals during NREM periods. Reading from top down, signals are lip EMG, chin EMG, from horizontal eye placement, and frontal EEG. Amplitude for the top three traces is 50 microV/division and 100 microV/division for EEG. Time is 1 sec/division.

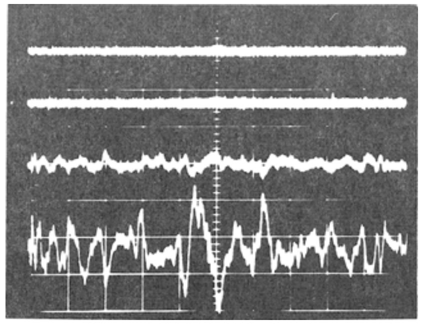

Fig. 2. Illustration of signals during a visual dream, as in Fig. 1.

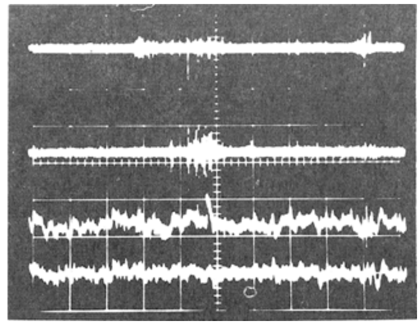

Fig. 3. Illustration of signals during a conversational dream, as in Fig. 1.

significance (A = .440 and A = .401, respectively). No other differences in Table 1 are significant. The nature of these results is illustrated by the sample tracings in Figs. 1, 2, and 3. The relatively quiescent lip and chin EMG during the NREM period (Fig. 1) and visual dream (Fig. 2) can be seen to increase phasically during the conversational dream (Fig. 3). The rather large, slow waves from the frontal EEG placement (reflecting both brain and eye activity) during this particular visual dream (Fig. 2) is noteworthy.

In conclusion, we may note that: (1) both measures of covert oral behavior significantly increased during conversational dreams relative to amplitudes during preceding NREM periods; (2) during visual dreams covert oral behavior did not significantly increase; and (3) amplitude changes from NREM to REM periods for neck EMG were minor and nonsignificant. These results suggest that dreams containing auditory speech content are associated with increases in covert oral behavior; since these increases did not appear in the nonoral region sampled (viz, the neck), they seem to have been localized in the speech region. These findings are thus consistent with the hypothesis that covert oral response during dreaming, as in waking life, serves a linguistic function. Covert oral behavior may facilitate internal information processing during conversational dreams.

Table 1
Amplitude Changes (μV) of Psychophysiological Measures as a Function of Dream Content

	Type of Dream					
	Visual			Conversational		
Measure	NREM Period	REM Period	Difference	NREM Period	REM Period	Difference
Lip EMG	5.4	5.7	.3	5.1	7.0	1.9*
Chin EMG	8.8	8.6	−.2	7.9	10.7	2.8*
Neck EMG	29.3	29.1	−.2	24.9	25.0	.1
Horizontal Eye	43.0	50.6	7.6	51.7	61.3	9.6
Frontal EEG	4.2	5.1	.9	3.9	4.6	.8

*$p < .05$

REFERENCES

McGUIGAN, F. J. Feedback of speech muscle activity during silent reading. Science, 1967, 157, 579-580.

McGUIGAN, F. J. Covert oral behavior during the silent performance of language tasks. Psychological Bulletin, 1970, 74, 309-326.

ROFFWARG, H. P., DEMENT, W. C., MUZIO, J. N., & FISHER, C. Dream imagery: Relationship to rapid eye movements of sleep. Archives of General Psychiatry, 1962, 7, 235-258.