

PREVALENCE OF AUDITORY, OLFACTORY, AND GUSTATORY EXPERIENCES IN HOME DREAMS¹

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Summary.—Although numerous studies have investigated the content of laboratory and home dream reports, surprisingly little is known about the prevalence of various sensory modes in dreams. 49 men and 115 women completed a battery of questionnaires and kept a home dream diary for two to three consecutive weeks. Retrospective responses to the questionnaire indicate that approximately 33% of men and 40% of women recalled having experienced sensations of smell or taste in their dreams. A total of 3372 dream reports were collected and scored for unambiguous references to auditory, olfactory, and gustatory experiences. Auditory experiences were reported in approximately 53% of all dream reports. Olfactory and gustatory sensations occurred in approximately 1% of all dream reports. A significantly greater percentage of women than men reported one or more dreams containing references to olfactory sensations. The results lend support to previous studies which have shown that a variety of sensory experiences, although relatively rare, can occur in dreams.

Although many studies have investigated the content of laboratory and home dream reports, relatively little is known about the prevalence of various sensory modes in dreams that occur without known external stimuli. Of eight studies that have reported on the percentages of dream reports containing references to various sensory modalities (Bentley, 1915; Calkins, 1893; Hacker, 1911; Knapp, 1956; Kohler, 1913; McCarley & Hobson, 1979; Snyder, 1970; Weed & Hallam, 1896), six are based on dream reports from 13 or fewer subjects (Bentley, 1915; Calkins, 1893; Hacker, 1911; Knapp, 1956; Kohler, 1913; Weed & Hallam, 1896). Not surprisingly, there is also a paucity of data on sex differences in dreamed sensory experiences.

Thus, the goal of this study was to examine the prevalence of sensory imagery in the dreams of men and women employing two different approaches: (1) tabulation of retrospective responses to a questionnaire item about experiences of smell and taste in dreams and (2) examination of the prevalence of auditory, olfactory, and gustatory experiences in a large sample of home dream reports.

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METHOD

Subjects

Subjects were 49 men with a mean age of 33.2 yr. ($SD=13.5$) and 115 women with a mean age of 35.5 yr. ($SD=13.8$) who had been recruited through media advertisements for participation in a series of studies on the relation between personality measures and dream content.

After indicating an initial interest, participants were contacted by telephone and asked to attend an informational meeting. The meeting provided a brief explanation of the research and permitted the distribution of two research protocols. Signed consent forms were obtained from all participants. The procedures had been approved by the university ethics review committee.

Retrospective Accounts of Smell and Taste Dreams

The first research protocol required participants to complete a battery of personality questionnaires as well as a 68-item Sleep/Dream Questionnaire. The latter included questions that asked whether the subject remembered ever experiencing sensations of smell or taste in their dreams. Answers to this question were tabulated separately for the men and women.

Self-reports of Auditory, Olfactory and Gustatory Dreams in Home Logs

The second protocol required subjects to record all the dreams they could remember for 14 to 21 consecutive morning awakenings. These dreams were written in a booklet of record sheets which was kept by the subject's bed. The record sheets also prompted the subject to record the theme, emotions, and clarity of recall associated with each remembered dream. Also, subjects specified the date of the dream and the elapsed time between waking and recording the dream. Since the evaluation of sensory experiences in dreams was not the focus of the original investigation, subjects were not asked to take special note of sensory events in their dreams.

Dreams written on the original record sheets were then scored for unambiguous references to auditory, olfactory, and gustatory experiences. Dreams were scored as containing auditory elements if they contained any type of vocalizations (the dreamer is speaking, yelling, or hearing someone else speak) or sounds, e.g., thunder, doorbell ringing, dog barking. Dream reports were scored as containing olfactory or gustatory sensations only if they contained explicit positive examples of such sensations. Dream reports that contained ambiguous references to olfactory or gustatory sensations were not scored as containing that sensory modality, e.g., "We went to a restaurant and it was really good."

Statistical Analysis

Domhoff (1996), in his volume on the quantitative approach to dream

content, discussed a number of reasons for using percentages (or proportions) when dealing with dream-content categories, e.g., unequal report lengths, variations in raw frequencies. He also presented several cogent arguments favoring the use of Cohen's (1977) *b* statistic in determining the significance of differences between two independent proportions—the type of data collected in the present study. When used with a percentage-based approach and two-sample designs, the *b* statistic yields the same information as other statistical alternatives such as correlation and chi squared.

RESULTS

Retrospective Accounts of Smell, Taste and Pain Dreams

Table 1 presents the percentage of men and women who indicated on the Sleep/Dream Questionnaire that they had experienced sensations of smell or taste in their dreams at least once. Although retrospective accounts of dreams containing olfactory and gustatory sensations were each reported by a larger proportion of women than men, none of these apparent differences reached statistical significance ($p > .05$).

TABLE 1
PERCENTAGE OF SUBJECTS REPORTING RECALL OF EXPERIENCED SENSATIONS OF SMELL OR TASTE IN THEIR DREAMS AT LEAST ONCE

Sensory Modality	% Men (<i>n</i> = 49)	% Women (<i>n</i> = 115)	% Total (<i>N</i> = 164)	<i>b</i>	<i>p</i>
Olfactory	34.7	40.9	39.0	0.12	ns
Gustatory	32.7	38.3	36.6	0.13	ns

Home Dream Reports

During the 2- or 3-wk. period of home-dream recording, subjects reported a mean of 20.6 dreams each ($SD = 10.8$) for a total of 3372 dreams. Men reported a mean of 18.3 dreams ($SD = 8.9$) and women a mean of 21.5 dreams ($SD = 11.3$). This frequency difference was not significant ($t_{162} = 1.76$, ns).

Table 2 presents the frequency of unambiguous reports of different sensory modes for the sample of dreams. Results of previous studies are included for comparison purposes. With the exception of the study by Knapp (1956), who did not include references to speech in his tabulation of auditory dreams, previous estimates of the prevalence of auditory experiences in dreams range from 53% to 93% while such experiences were found in approximately 53% of all dream reports in the current study. Consistent with the majority of earlier findings, explicit references to olfactory and gustatory sensations occurred in approximately 1% of all dream reports. In particular, these results are similar to those of Snyder (1970) for a large sample of

TABLE 2
FREQUENCY OF EXPLICIT REPORTS OF DIFFERENT SENSORY MODES IN 3372 DREAMS

Study	Subjects	Dreams	% Auditory	% Olfactory	% Gustatory
Present Study (Men)	49	897	55.7	0.11	0.78
Present Study (Women)	115	2475	52.5	1.33	0.89
Present Study (Total)	164	3372	53.2	1.01	0.86
Weed & Hallam (1896)	6	381	69	7	6
Calkins (1903)	2	298	53	<1	0
Hacker (1911)	4	100	72	3*	3*
Kohler (1912)	1	100	64	<1	<1
Bentley (1915)	4	54	92		
Knapp (1956)	13	437	4	<1*	<1*
Snyder (1970)†	56	635	76	<1	<1
McCarley & Hobson (1979)†	?	100	55		

*Olfactory and gustatory categories combined. †Laboratory dreams.

dreams collected from a wide range of subjects but in a sleep laboratory setting. Women's dream reports were more likely to contain olfactory or gustatory sensations than were men's. References to auditory experiences, however, occurred in a slightly higher percentage of men's dream reports. Edited transcripts of dream reports containing references to auditory, olfactory, or gustatory sensations appear in Appendix 1 (pp. 825-826).

The percentage of men and women who reported one or more dreams containing unambiguous references to auditory, olfactory, or gustatory sensations is presented in Table 3. A significantly greater proportion of women reported one or more dreams containing references to olfactory sensations ($p < .01$). Although women were more likely to report gustatory dreams, this difference was not significant ($p > .05$).

TABLE 3
PERCENTAGE OF SUBJECTS REPORTING ONE OR MORE DREAMS IN THEIR
LOGS CONTAINING REFERENCES TO AUDITORY, OLFACTORY, OR GUSTATORY SENSATIONS

Sensory Modality	% Men ($n = 49$)	% Women ($n = 115$)	% Total ($N = 164$)	<i>b</i>	<i>p</i>
Auditory	100.0	96.5	97.6	0.20	ns
Olfactory	2.0	20.9	15.2	0.64	< .01
Gustatory	10.2	14.8	13.4	0.12	ns

DISCUSSION

Results of analysis of the retrospective responses to the questionnaire indicated that approximately 33% of men and 40% of women recalled having experienced sensations of smell or taste in their dreams.

Of the 3372 dreams reported in the home dream logs, 160 subjects re-

ported a total of 1794 dreams which contained references to auditory sensations, 25 subjects reported a total of 34 smell dreams and 22 subjects reported a total of 29 taste dreams. The results reinforce those of previous studies which have indicated that the whole range of sensory experiences can occur in dreams (e.g., Zadra, Nielsen, & Deakos, 1996). Moreover, the prevalences we report are very likely underestimated by the methods employed as our subjects were not specifically instructed to note the presence of sensory experiences in their dreams. Nevertheless, it is interesting to note how analogous are the present findings with those from previous studies with respect to the distribution of the different sensory modalities in dreams. The results also indicate that olfactory experiences are reported approximately twelve times more frequently in women's dreams (see Table 2) and that a significantly greater proportion of women reported one or more dreams containing references to olfactory sensations (see Table 3).

With a strong sociocultural bias favoring the processing of visual perceptions (Posner, Nissen, & Klein, 1976) as well as evidence that nonvisual imagery, e.g., haptic, is more volatile than visual imagery (Posner, 1976), it is quite likely that subjects in our study were apt to recall the visual content of their home dreams to the exclusion of the imagery in the other modalities. The finding that olfactory experiences were reported more frequently in women's dreams as well as by a significantly larger proportion of women than men may reflect the fact that women are more interested in odor than are men (Herz & Cahill, 1997). Although odor perception does not appear to be affected by subjects' sex at above threshold concentrations (Herz, 1997), there is some evidence to suggest that women are more sensitive than men in detecting odors at subthreshold concentrations (Whisman, Goetzinger, Cotton, & Brinkman, 1978). Thus, it is also possible that the presence of odors at molar concentrations is more likely to be incorporated into women's dreams than in men's. On the other hand, such differences may also reflect a more fundamental difference in the dream processes of the two sexes. We have previously found sex differences in dream content which seem more likely to result from differences in dream-formation processes than from sociocultural biases, e.g., the preferential occurrence of characters' faces (Nielsen & Ouellet, 1996).

That the more infrequent modalities of smell and taste occur at all in dream reports is an important indication of the representational capacities of dreaming—and probably of imagery more generally. The finding is consistent with recent research showing the existence of imagery in both olfactory (Carrasco & Ridout, 1997; Lyman & McDaniel, 1986) and gustatory (Drummond, 1995) modalities. Although some researchers take the position that olfactory imagery is not possible (Herz & Engen, 1996), the spontaneous occurrence of olfactory imagery in dreams may differ from "willful" olfactory

imagery that may occur upon instruction during the waking state. For instance, limbic structures which might yield such spontaneous occurrences during dreams may not be operational during the waking state. Nevertheless, it is likely that the relatively rare occurrence of these modalities during dreaming is not because their representation is beyond imaginal capacity. Rather, either such sensations are not usually *spontaneously* generated during dreaming, i.e., are not a necessary component of dreaming's supposed memory/adaptational functions, or they depend upon external sensory stimuli to trigger them. However, sensory triggers may be selectively blocked at the thalamic level by the raised afferent thresholds of REM sleep (e.g., Steriade, 1994). Of course, both of these inhibiting conditions may be true, thereby seriously disfavoring appearance of gustatory or olfactory sensations during dreaming.

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APPENDIX 1

EDITED TRANSCRIPTS OF DREAMS CONTAINING REFERENCES TO AUDITORY, OLFATORY, OR GUSTATORY SENSATIONS

Auditory dream (24-yr.-old female): I'm at home scrubbing the bathtub. I can't believe how dirty it is and I'm mad at my roommate for making this mess. The *phone rings* and I go answer. I keep *saying 'Hello, Hello!'* but there's no answer. Finally, *I hear some giggling* on the other end of the line and figure that it's just some kind of crank call. I'm quite upset and now the phone is all dirty and wet.

Auditory dream (41-yr.-old male): I dreamed that I was in my living room watching the television. *I hear some kids yelling outside* and go to the window to see what's happening. There's a bunch of kids pushing and shoving each other and it looks like it might break out into a fight. I go outside and tell them to stop and go home or I'll call the police. One of the kids, he couldn't have been more than 12, looks at me straight in the eyes and *says "Shut up and mind your business or I'll smash your windows!"* At that point we *hear sirens* and the kids take off. I stay on the sidewalk and see a fire truck zoom by the corner of my street.

Olfactory dream (39-yr.-old female): These two guys that I had hired to clean my house are in my home. When I walk in, I notice that they are cleaning the lower floor. I go upstairs to check what they have done and see their big dog, a pitbull, that they have tied with a long rope. The dog is walking everywhere in the house. There's *a disgusting smell* and everything is a mess and lots of stuff was broken by the dog. I tell them to take the dog out of the house but I'm scared since they look as menacing as their dog.

Olfactory dream (28-yr.-old female): I'm walking with my friend H. We're heading towards some steps which lead to an underground shelter. H tells me some unpleasant things about a friend, and I react very strongly. She is furious and irritated with me because of how I reacted. I return up the stairs and come to a hill, but as I turn I see a large number of fish which are swimming everywhere and there are some kids who are having fun by killing them with large sticks. *A putrid smell forces me to run* and I hope to reach the top of the hill and jump off into the *water to avoid the awful smell* but I'm not sure that the water will be deep enough.

Gustatory dream (34-yr.-old female): I'm with my friend K going to a party that some friends are organizing for our kids. We get there and see that the house has all these lovely decorations. Our friends have done a great job with all the preparations and there is a big table with all kinds of desserts on it. I'm quite hungry and take two of my favorites (strawberry cheesecake and a chocolate mousse) and sit down to chat with my friends. *The cheesecake tastes wonderful—it's really rich and the strawberries are particularly good.* I compliment G who has made the desserts and ask her for her recipe. She tells me that the secret is in how the ingredients are mixed. K brings me *a hot chocolate which is thick and delicious.* I'm tempted to go get another piece of cake but hesitate because of my weight.

Gustatory dream (24-yr.-old male): I was waiting outside of the Royal Victoria Hospital for some friends to come and pick me up. They were late, which annoyed me. Finally they came in a red convertible. P didn't want to get out of the front seat to let me in so I just jumped into the back seat. I'm getting hungry and remember that I have a peach in my knapsack. I grab a bite but it *tastes awful.* I spit it out into my hand and notice that the inside is all brown—it's obviously gone bad. I throw it all onto the street but then feel bad about littering like that.