Ethology **83**, 295—305 (1989)

ISSN 0179-1613

Department of Psychology, University of Maryland Baltimore County, Baltimore

Laughing, Smiling, and Talking: Relation to Sleeping and Social Context in Humans

ROBERT R. PROVINE & KENNETH R. FISCHER

PROVINE, R. R. & FISCHER, K. R. 1989: Laughing, smiling, and talking: relation to sleeping and social context in humans. Ethology **83**, 295—305.

Abstract

The probabilities of laughing, smiling, or talking during a given hour and in various social environments were investigated by having undergraduate college students record their performance of these activities in a log book during a one-week period. All three activities were least likely to occur during the hours immediately before bedtime and after waking and were most frequent in social situations. Smiles and laughs, like talking, were performed primarily during social encounters and were often part of verbal and nonverbal conversations. Because laughing and smiling are phasic social acts, they are of limited value as indices of ongoing (tonic) emotional state. The role of laughing, smiling, and talking in communication, the production of mood, and social bonding is considered.

Corresponding author: Robert R. PROVINE, Department of Psychology, University of Maryland Baltimore County, Baltimore, Maryland 21228, U. S. A.

Introduction

Laughing, smiling, and talking are among the most common and prominent species-typical human social signals. Although these activities differ at the level of motor act, sensory channel, message, and richness of information content, all are important in social discourse. Their diversity was a factor in their selection for analysis. Laughing and talking are principally auditory signals, functioning in light or darkness and around obstructions. Smiling, in contrast, is a visual signal that requires line-of-sight visual contact from the recipient to the illuminated face of the sender. Talking was selected for study because its role in communication is unquestioned and because it is seldom considered in concert with laughing and smiling.

In accord with their significance, human laughing, smiling, and talking have extensive research literatures (BERNTHAL & BANKSON 1988; BLACK 1984; EKMAN 1982; GREGORY 1924; STEARNS 1972; SULLY 1902) complete with analyses of

development (BERNTHAL & BANKSON 1988; EIBL-EIBESFELDT 1975; SROUFE & WATERS 1976), cross-cultural comparisons (EKMAN 1973; EIBL-EIBESFELDT 1975), evolution (DARWIN 1872; EIBL-EIBESFELDT 1975; EKMAN 1973; HINDE 1974; HOOFF 1972; LOCKARD et al. 1977; SEBEOK 1968), and pathology (BERNTHAL & BANKSON 1988; BLACK 1982). The literature on laughing, smiling, and talking sometimes deals with an assortment of compartmentalized and homocentric issues that complicate comparisons between behavior and species. Laughter, for example, is often considered in the context of humor, smiling is treated as a facial gesture that signals positive mood or emotion, and talking is considered in the context of language and speech.

The present analysis studies laughing, smiling, and talking using parallel procedures that facilitate direct comparisons between behavior and species. It strips laughing, smiling, and talking of their richness and subtlety and treats them as motor events distributed in time. This austere approach may reveal overlooked or neglected phenomena and may suggest ancient, common roots of vocal and gestural behavior.

The present behavioral analysis is made possible by the use of a self-report procedure that is unusual in ethological research, in part because the discipline focuses on nonhuman subjects (PROVINE et al. 1987). The procedure permitted the collection of over one subject-year of data in the form of 72 one-week-long samples of behavior. Each subject recorded his or her laughing, smiling, or talking in a personal log book during a one-week period. The discreteness and amplitude of the target behavior minimize the problems associated with self-report procedures. Self-report substitutes the informed judgement of the subject about his or her own behavior for the inferences of an often obstrusive outside observer. To decrease individual differences in record keeping, participants noted only the hour of a behavioural episode, not each laugh, smile, or word (unless they were isolated occurrences), and the results were reported as the probability of occurrence of behavior, not its frequency, at a given hour.

I. Laughing

A laugh is an explosive and often recurrent exhalation that produces a loud and distinctive sound, usually as an expression of merriment. A chuckle is a low amplitude laugh. The present study describes the time of day, relation to sleeping, and social context of laughing.

Materials and Methods

The methods of the present studies were similar to those of PROVINE et al. (1987).

Subjects. The 28 subjects (13 males and 15 females) had an average age of 19.9 yr (range 18—27 yr). As in all of the studies reported in this paper, the subjects were volunteers from introductory psychology classes who signed up for a study on facial expression. All received class-participation credit and could participate in only one of the present series of three studies. All subjects were required to have a watch in good working order that was calibrated with that of the experimenter on the day before the beginning of the week-long observation interval.

Procedure. Each subject was supplied with a small, spiral log book with an attached pencil. The log was divided into 7 daily segments of 24 h each. Subjects were instructed to keep the log with them

at all times during the week-long recording period and to record their laughing episodes. In the log book, subjects were instructed that "A laughing episode is a laugh or series of laughs unique to a situation. Your are to respond to each laughing episode, not to each laugh. Do not respond if you do not laugh. 1) Record every laughing episode by placing a check in the appropriate category: A) alone, no social stimulus, i.e., spontaneous laughter; A—M) alone with media stimuli, i.e., watching television alone; S) socially, in social situations, i.e., joking with friends; S—M) socially with media stimuli, i.e., watching television or a movie with friends. 2) If more than one laughing episode occurs during the same h, check the appropriate category for each. 3) Record the specific activity being performed when each laughing episode occurs. 4) Record mealtimes each day. 5) Record time spent sleeping (i.e., bed and waking times). For example, 23.00—07.15 h. 6) Provide personal information about: age, gender, job (if any), do you live in the dorms, and the number of people that you live with. 7) Comments. Note special circumstances that may affect your laughter or behavior (i.e., sickness, anxiety, studying for exams).

Several steps were involved in the analysis of the log-book data. First, it was determined if an individual laughed or did not laugh during a given h on a given day. The proportion of the 7 daily records for a given h during which at least one laugh occurred was calculated for each subject. These proportions were averaged across all subjects to determine the mean proportion of days during which subjects laughed at least once during a given h. The probability of laughing at least once during a given h was calculated instead of laughing frequency; the greater effort required for subjects to maintain accurate records of frequency might have emphasized differences in the subjects' reliability in record keeping. Extremely high or low laughing frequencies of a few individuals might have had a disproportionately large effect on the averaged data. These procedures were also used to derive the mean proportion of days during which subjects laughed in each of the four social contexts or slept during a given h.

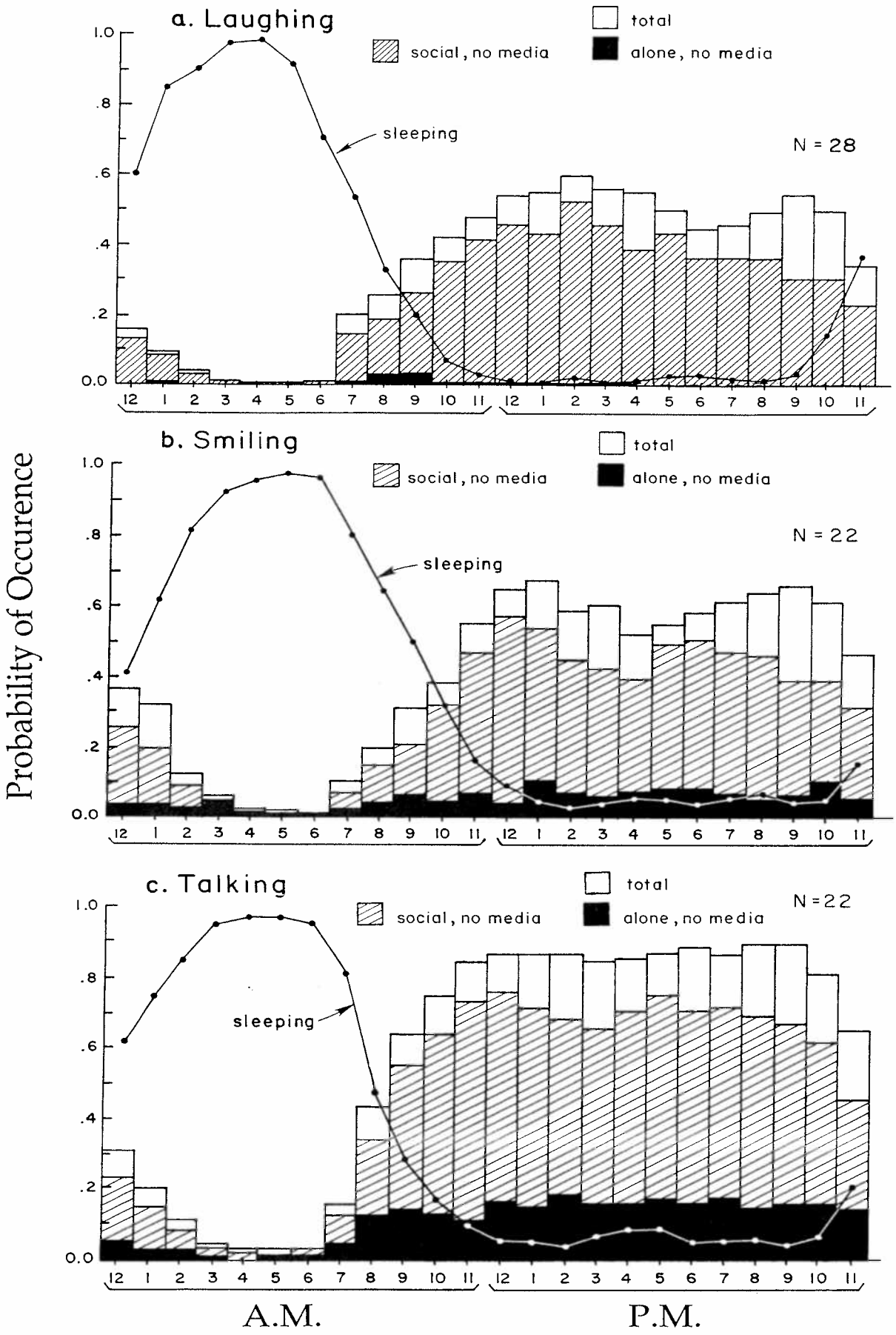
To clarify the correlation between laughing and waking and bedtimes, the mean proportion of days in which laughing occurred during each of the four hourly intervals after waking and before sleeping was calculated (morning waking, +1 h, +2 h, +3 h, +4 h; bedtime, −1 h, −2 h, −3 h, −4 h). This procedure compensated for between- and within-subject differences in bedtimes, waking times, and the duration of sleep. The significance of the difference between the number of days in which subjects laughed during different pairs of the four 1-h intervals before and after sleeping (eg. +1 h vs. +2 h, +1 h vs. +3 h, +1 h vs. +4 h after waking) was determined using a χ^2 test (McNemar 1962, p. 225; Provine et al. 1987). The small variations of n in the pre- and post-sleep χ^2 analyses are the result of many subjects not having 4 pre-sleep h before the onset of record keeping at 0 h on Day 1, and 4 post-sleep h before record keeping was terminated at 24.00 h on Day 7.

Results

To simplify the presentation, only data for total laughing, laughing in a social context without media (social, no media), and laughing when alone in the absence of media (alone, no media) are plotted here (Figs. 1, 2 a). The data analysis focusses upon these categories because they best illustrate the importance of the social context of laughing; most laughing that occurred outside of a social

Table 1: Probability of awake subjects laughing, smiling, or talking in different social and media environments

	Laughing			Smiling			Talking		
	Media	No media	Total	Media	No media	Total	Media	No media	Total
Alone	.072	.012	.083	0.64	.074	.130	.130	.168	.250
Social	.064	.387	.428	.106	.473	.538	.281	.721	.814
Total	.129	.395	.494	.169	.514	.624	.359	.781	.900
n	28			22			22		


a. Laughing
total
social, no media
alone, no media
sleeping
N = 28
b. Smiling
total
social, no media
alone, no media
sleeping
N = 22
c. Talking
total
social, no media
alone, no media
sleeping
N = 22
Probability of Occurence
1.0
.8
.6
.4
.2
0.0
12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11
A.M.
P.M.

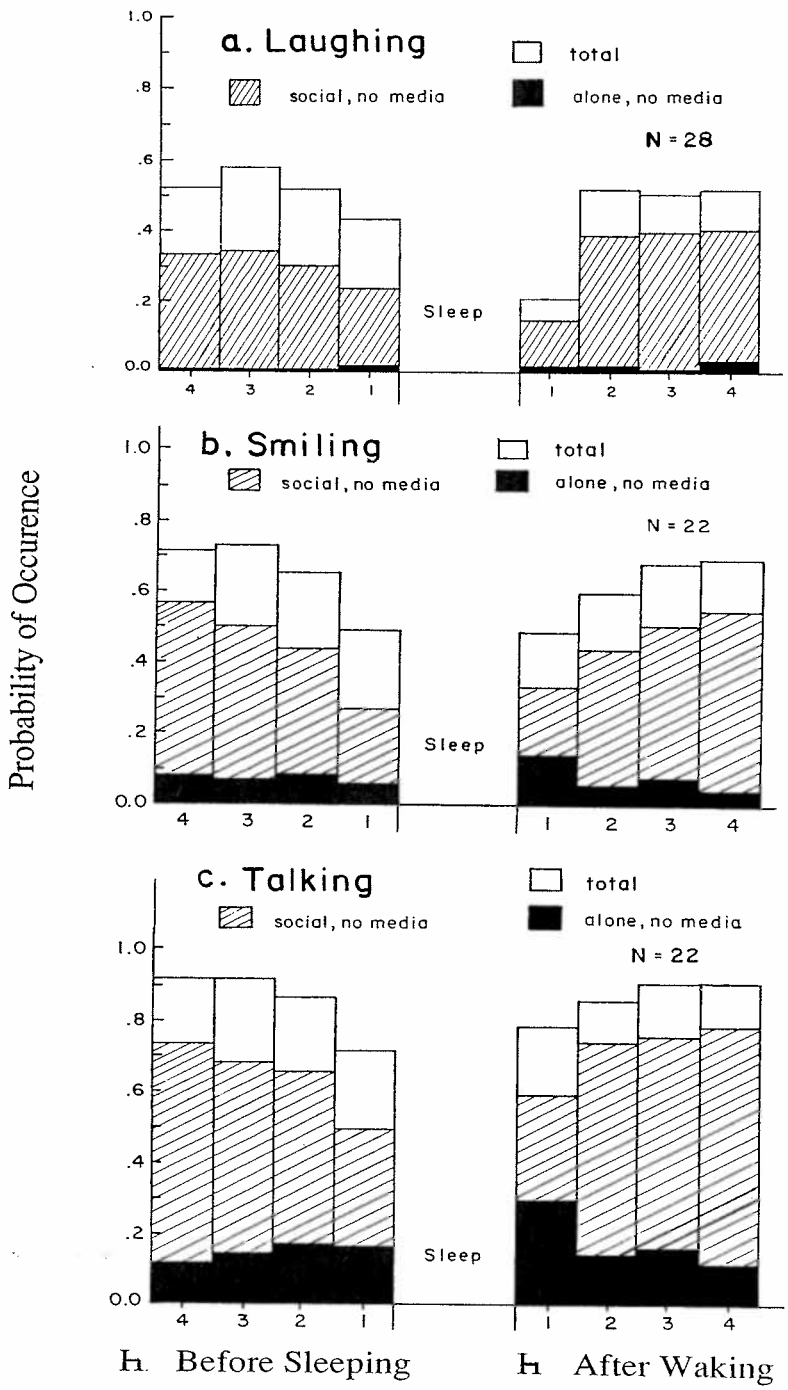


Fig. 2: Probability of laughing, smiling and talking before sleeping and after waking in different social and media environments. Probability refers to the mean proportion of days during which a behavior was performed at a given h before or after waking during the 7-day observation period. N: number of subjects who recorded their behavior during the 7-day observation period

Fig. 1: Probability of laughing, smiling and talking in various social and media environments during a 24-h interval. The probability of occurrence is the mean proportion of days during which a behavior was performed at a given h during the 7-day observation period. N: number of subjects who recorded their behavior during the 7-day observation period

setting was the product of media stimulation such as books, television, and cinema. (Data for all 9 of the possible categories of laughing are presented in Table 1.)

The relationship between laughing, waking, and sleeptime was clarified by calculating the mean proportion of days on which subjects laughed during each of

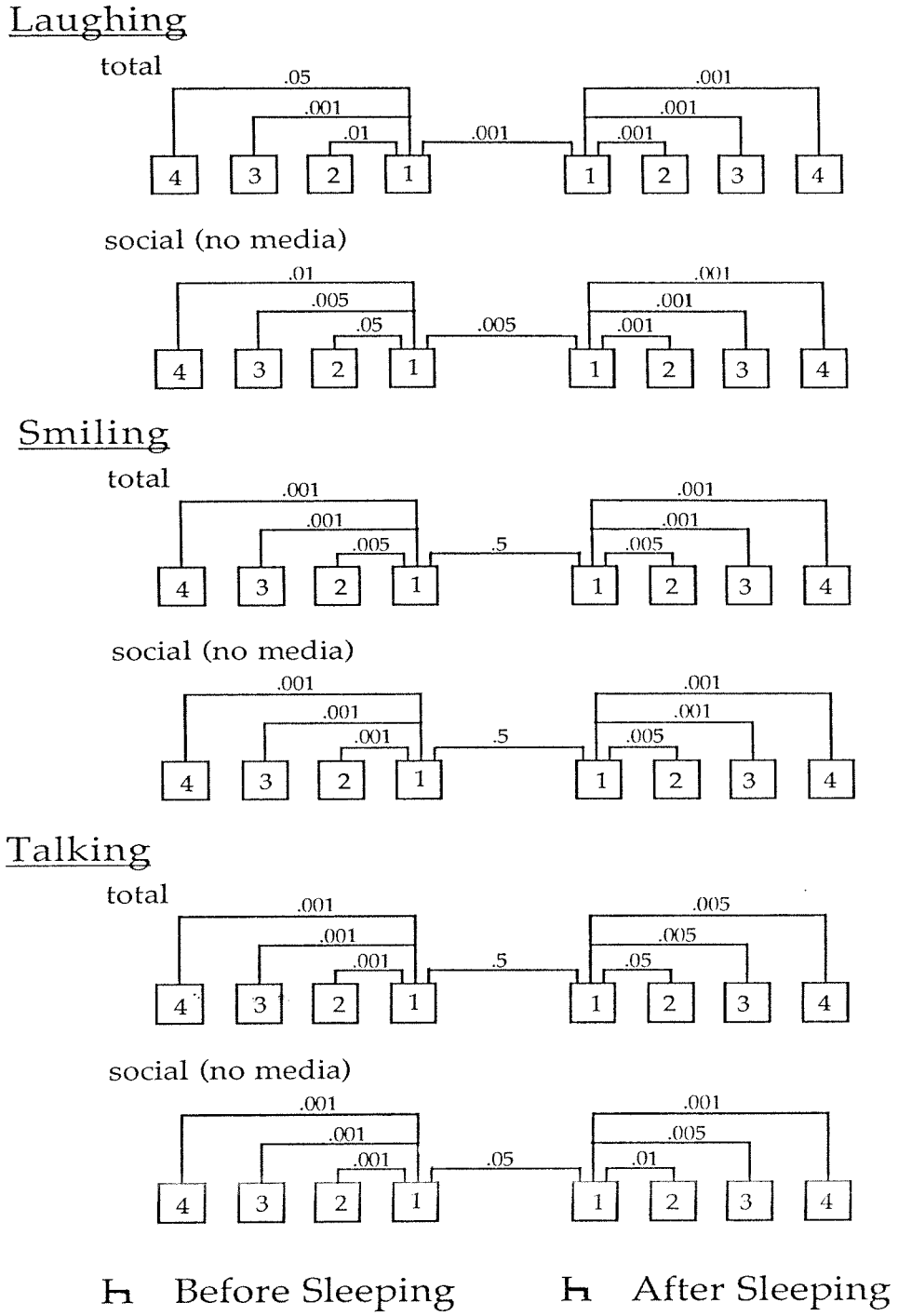


Fig. 3: Significance of differences between the probability of various behavior patterns during hourly intervals before and after sleeping as determined by χ^2 tests

the four hourly intervals preceding bedtime and following waking (Fig. 2 a). In general, the probability of total and social laughing (no media) declined the h preceding bedtime. After a nadir during the h after waking, the probability of total and social laughing increased sharply. However, the probability of laughing when alone without media stimulation was extremely low at all times (Figs. 1 a, 2 a). Laughing almost never occurred out of a social or media context.

Chi-square tests confirmed the trends noted above (Fig. 3). Total laughing was less probable during the pre-bedtime h than during the second (Fig. 3), third and fourth h before sleeping. It was also less likely during the h after waking than during the second, third, and fourth post-waking h. Total laughter was less probable during the post-waking than the pre-bedtime h. These trends held for social laughing. Social laughing (no media) was also less likely during the pre-bedtime h than during the second (Fig. 3), third, and fourth pre-bedtime h. Less social laughing occurred during post-waking h than during the second, third, and fourth post-waking h. Significantly more social laughing was performed during the pre-bedtime than the post-waking h. Too little laughing was performed by solitary subjects to warrant tests of significance.

Several striking trends were found in the mean proportion of days when awake subjects laughed at a given h in different social and media environments (Table 1). (These data concerning mean probabilities do not meet the criteria for traditional statistical tests.) Most important was the finding that in the absence of media, laughing was approximately 30 times as probable in a social than in a solitary condition. If total social and solitary (alone) laughing are contrasted (media and no-media conditions included), social laughing was over five times as likely as solitary laughing.

The virtual absence of laughing outside of social or media contexts indicates that laughing is a social signal and/or a response to social stimulation. The low probability of post-waking laughing is also of interest. Although this result may reflect a lack of necessary social stimulation, laughing had a relatively lower probability of occurrence after waking than smiling and talking, other socially oriented types of behavior (see below). The subjects' thresholds for laughing may have been relatively higher immediately after waking than at other times during the day.

II. Smiling

A smile is a change of facial expression in which the corners of the mouth curve slightly upward, usually as an expression of amusement, pleasure, or approval. The present study describes the time of day, relation to sleeping, and social environment of smiling.

Materials and Methods

Subjects. The 22 subjects (13 males and 9 females) had an average age of 19.0 yr (range 17—28 yr).

Procedure. The instructions to the subjects were a slight modification of those described for the first study. The log book instructed subjects to "record each smile by making a check in the appropriate category." The procedures used to analyze data about smiling were identical to those described in the first study about laughing.

Results

The circadian patterning of smiling and sleeping is shown in Fig. 1 b and the distribution of smiling relative to bed- and waking-times is given in Fig. 2 b. Total smiling was significantly less probable during the first than during the second (Fig. 3), third, and fourth pre-bedtime h. Total smiling was also less likely during the first than during the second, third, and fourth post-waking h. There was no difference between the probability of smiling during the pre-bedtime and post-waking h. Social smiling (no media) was significantly less likely during the first than during the second, third, and fourth pre-bedtime h. Less social smiling occurred during the h after waking than during the second, third, and fourth post-waking h. The difference between the probability of social smiling during the pre-bedtime and the post-waking h was not significant. Solitary smiling (no media) was never common, but was significantly more probable during the post-waking than during the pre-bedtime h (χ^2 [1,n = 144] = 5.26, $p < .025$).

The mean proportion of days when awake subjects smiled during a given h in different social and media environments is provided in Table 1. Total smiling was over 4 times as likely to be performed by subjects in social settings than when alone. In contrast to the large effect in the case of laughing, media were not an important condition for the production of solitary smiling.

III. Talking

Talking was included in the present analysis because its communication function is unquestioned. Talking, therefore, offers a useful contrast with laughing and smiling. Although the communication function of laughing and smiling is generally acknowledged, these activities are usually considered in the context of emotions, facial expressions, and sometimes nonverbal communication, and are seldom compared directly with speech, a topic that usually receives independent treatment as linguistic behavior. To permit a comparative analysis, the present study describes the circadian pattern, relation to sleeping, and social environment of talking using methods identical to those used for laughing and smiling.

Materials and Methods

Subjects. The 22 subjects (8 males and 14 females) had an average age of 20.0 yr (range 18—39 yr).

Procedure. The instructions to the subjects were a slight modification of those described for the first two studies. The log book instructed subjects to "record each speech episode by placing a check in the appropriate category. A lengthy conversation with friends or a single expletive uttered while alone are equally weighted and each should receive a check. Exclude vocalizations such as laughter, groans, or coughs, etc." Other instructions and quantitative procedures were identical to those described previously except that the term "talking" was substituted for that of "laughing" or "smiling".

Results

The mean proportion of days during which subjects were talking or sleeping at a given h is provided in Fig. 1 c. The probability of an awake subject talking during a given h usually exceeded 80 %, much higher than the 50—60 % range

typical of laughing and smiling (Table 1). The ceiling effect produced by the high frequency of talking may account, at least in part, for the relatively level circadian data in Fig. 1 c.

The relation between talking and bed- and waking-times is shown in Fig. 2 c. Total talking (no media) was significantly less probable during the pre-bedtime h than during the second (Fig. 3), third, and fourth h before retiring. Significantly less total talking occurred during the post-waking h than during the second, third, and fourth h after waking. Social talking (no media) was less likely during the pre-bedtime h than during the second, third, and fourth h before bedtime. Similarly, social talking was less probable during the post-waking h than during the second, third, and fourth h after rising. The differences between the probability of talking (total) during the pre-bedtime and post-waking h was not significant. However, significantly more social (no media) talking occurred during the post-waking than during the pre-bedtime h. There was a surprisingly high level of solitary (no media) talking during the post-waking h. The probability of solitary talking (no media) during the post-waking h was significantly higher than that during the pre-bedtime (χ^2 [1,n = 140] = 7.11, $p < .01$), and second post-waking h (χ^2 [1,n = 152] = 11.76, $p < .001$).

Table 1 gives the mean proportion of days when awake subjects talked at a given h in different social and media circumstances.

Discussion

The probability of laughing, smiling, or talking varied dramatically as a function of time of day, relation to sleeping, and social context. All three activities were, generally, least likely to occur immediately before bedtime and after waking. This low level of responding was probably not a consequence of negligent record keeping by drowsy subjects because a previous study that used similar procedures detected peak levels of other activities, yawning and stretching, during the pre-bedtime and/or post-waking hours (PROVINE et al. 1987). Talking was by far the most frequent of the currently studied behavior, followed by smiling and then by laughing, a distant third. The actual difference between the frequency of these activities was underestimated in the present report because of the buffering effect of using the probability of occurrence per hour as a metric for rate.

The performance of laughing, smiling, and talking was associated strongly with social context. These activities were performed infrequently by solitary subjects without media stimulation. The no-media condition best represents the environment of our ancient ancestors who had less access to such stimuli. The social-facilitation effect was especially strong in the case of laughing (no media), which was over 30 times as likely to be performed by subjects in social than in solitary settings. Smiling (no media) was over 6 times and talking was over 4 times as likely to occur in social than in solitary situations. Solitary behavior did occur. Solitary talking (no media) in the form of singing, rehearsing upcoming conversations, studying, cursing and "thinking out loud" were reported, occurring most

often during the post-waking hour. Smiling, but not laughing, was a common element of these morning soliloquies. The self-report method was especially useful for collecting data on these potentially embarrassing solitary activities that may be inhibited by the presence of observers; the social sanctions against private "conversations" and emotional expressions are well known.

The finding that indices of positive mood such as laughing and smiling occur mostly in social settings has implications for mental health practice. Social stimulation from humans and companion animals and perhaps media stimulation may be therapeutic for the depressed, particularly if facial expressions actively drive or enhance the moods and emotions (i.e. EKMAN et al. 1983; ZAJONC 1985).

The relation between social context and expressive behavior indicates a limitation of using phasic (transient) social signals such as smiling or laughing as indices of tonic (ongoing) states such as mood. Although a happy person probably laughs or smiles more than a sad one, these behavior patterns are performed primarily in response to face-to-face encounters with others, not as ongoing expressions of an emotional state. Thus, a happy person may show a relatively neutral facial expression and laugh or smile only when greeting or interacting with someone. We seldom laugh, smile, or talk in response to inanimate objects.

The social, phasic character of smiling and laughing emphasized in the present research is supported by the findings of a naturalistic study of smiling conducted by KRAUT & JOHNSTON (1979) at a bowling alley. Bowlers often smiled during social interactions, but not necessarily after receiving good scores (strikes or spares). Furthermore, bowlers rarely smiled while facing the pins, but often smiled when facing their friends. These and other results led KRAUT & JOHNSTON (1979) to suggest "a strong and robust association of smiling with social motivation and an erratic association with emotional experience" (p. 1539). LOCKARD et al. (1977) provided additional evidence of the social context of smiling and laughing and noted differences between the frequency and intensity of these phasic, social acts when performed in different social situations. Anger offers an interesting parallel to laughing and smiling; it too is a response to the acts of people, not the acts of nature or objects (AVERILL 1983).

The social circumstances that most favor laughing and smiling are similar to those that favor talking. Although laughing and smiling can occur independently of talking, all three activities are often performed as part of a given social episode. Conversation itself is amply punctuated with smiles and laughs. The co-incidence of laughing, smiling, and talking is informative. Talking may be more akin to laughing, smiling, and other nonverbal social signals than is often appreciated. For example, "small talk" may have evolved to facilitate or maintain social bonds among our tribal ancestors, a role independent of linguistic content and similar to that served by mutual grooming among members of contemporary primate troops. This social-bonding function is characteristic of the "phatic" speech of MALINOWSKI (cited in FARB 1974) "in which ties of union are created by a mere exchange of words" (p. 23). In this context, the act of speaking is often more important than what is said.

Acknowledgements

We gratefully acknowledge the assistance in data collection of K. G. PROVINE and B. C. CURCHACK, the statistical advice of M. E. DEMOREST, and the editorial comments of A. C. CATANIA, S. FELDSTEIN, and two anonymous reviewers.

Literature Cited

AVERILL, J. R. 1983: Studies on anger and aggression. Am. Psychol. **38,** 1145—1160.

BERNTHAL, J. E. & BANKSON, N. W. 1988: Articulation and Phonological Disorders. (2nd ed.). Prentice Hall, Englewood Cliffs.

BLACK, D. W. 1982: Pathologic laughter: A review of the literature. J. Nerv. Mental Dis. **170,** 67—71.

— — 1984: Laughter. J.A.M.A. **252,** 2995—2998.

DARWIN, C. 1872: The Expression of the Emotions in Man and Animals. Appleton, New York, 1920.

EIBL-EIBESFELDT, I. 1973: The expressive behavior of the deaf- and blind-born. In: Social Communication and Movement. (CRANACH, M. VON & VINE, I., eds.) Acad. Press, New York, pp. 163—194.

— — 1975: Ethology. (2nd ed.). Holt, Rhinehart, and Winston, New York.

EKMAN, P. 1973: Cross-cultural studies of facial expression. In: Darwin and Facial Expression: A Century of Research. (EKMAN, P., ed.) Acad. Press, New York, pp. 169—222.

— — 1982: Emotion in the Human Face. (2nd ed.). Cambridge Univ. Press, Cambridge.

— —, LEVENSON, R. W. & FRIESEN, W. V. 1983: Autonomic nervous system activity distinguishes between emotions. Science **221,** 1208—1210.

FARB, P. 1974: Word Play. Knopf, New York.

GREGORY, J. C. 1924: The Nature of Laughter. Kegan Paul, Trench, Traubner & Co., New York.

HINDE, R. A. 1972: Non-Verbal Communication. Cambridge Univ. Press, Cambridge.

— — 1974: Biological Bases of Human Social Behavior. McGraw-Hill, New York, pp. 127—132.

HOOF, J. A. R. M. VAN 1972: A comparative approach to the phylogeny of laughter and smiling. In: Non-Verbal Communication. (HINDE, R., ed.) Cambridge Univ. Press, Cambridge, pp. 209—241.

KRAUT, R. E. & JOHNSTON, R. E. 1979: Social and emotional messages of smiling: An ethological approach. J. Per. Soc. Psychol. **37,** 1539—1553.

LOCKARD, J. S., FAHRENBRUCH, C. E., SMITH, J. L. & MORGAN, C. J. 1977: Smiling and laughter: Different phyletic origins. Bull. Psychonom. Soc. **10,** 183—186.

MCNEMAR, Q. 1962: Psychological Statistics. Wiley, New York.

PROVINE, R. R., HAMERNIK, H. B. & CURCHACK, B. C. 1987: Yawning: relation to sleeping and stretching in humans. Ethology **76,** 152—160.

SEBEOK, T. A. 1968: Animal Communication. Indiana Univ. Press, Bloomington.

SROUFE, L. A. & WATERS, E., 1976: The ontogenesis of smiling and laughter: A perspective on the organization of development in infancy. Psychol. Rev. **83,** 173—189.

STEARNS, F. 1972: Laughing. C. C. Thomas, Springfield.

SULLY, J. 1902: An Essay on Laughter. Longmans, Green, and Co., New York.

ZAJONC, R. B. 1985: Emotion and facial efference: A theory reclaimed. Science **228,** 15—21.

Received: April 13, 1989

Accepted: August 4, 1989 (G. Barlow)