Social and Emotional Messages of Smiling: An Ethological Approach

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Did smiling evolve as an expression of happiness, friendliness, or both? Naturalistic observation at a bowling alley ($N = 1,793$ balls) shows that bowlers often smile when socially engaged, looking at and talking to others, but not necessarily after scoring a spare or a strike. In a second study, bowlers ($N = 166$ balls) rarely smiled while facing the pins but often smiled when facing their friends. At a hockey game, fans ($N = 3,726$ faces) smiled both when they were socially involved and after events favorable to their team. Pedestrians ($N = 663$) were much more likely to smile when talking but only slightly more likely to smile in response to nice weather than to unpleasant weather. These four studies suggest a strong and robust association of smiling with a social motivation and an erratic association with emotional experience.

Everyday experience suggests that smiling is one of the most common nonverbal signals used in communication among humans. Despite this, and despite more than 100 years of research on facial expressions, we still know relatively little about the causation of smiling and its social functions. In this article we attempt to provide evidence about the causation of smiling in social settings and to raise some neglected questions about the analysis of facial expressions in general.

Research and thought on the facial expression of emotion has had a checkered history since the publication of Darwin's *The Expression of the Emotions in Man and Animals* in 1872, as has been documented by a number of excellent reviews (Ekman, 1973; Ekman, Friesen, & Ellsworth, 1972; Izard, 1971), but recently several of the perennial questions in this field have been settled. In a variety of studies researchers have shown that people can consensually and accurately recognize at least six emotional expressions from pictures of faces (e.g., Ekman, 1972; Ekman et al., 1972; Tomkins & McCarter, 1964) and that these abilities seem to be universal among humans (Eibl-Eibesfeldt, 1972 and 1973; Ekman, 1973; Izard, 1971; Vinacke, 1949; Vinacke & Fong, 1955). Ekman (1972) has proposed a general model for the factors influencing facial expression that we take as representative of this "emotional expression approach" to facial expressions, and we explicate this model in more detail below for the particular case of smiling. Tomkins' (1962) and Izard's (1971) positions emphasize the influence of facial expressions on emotional experience more than Ekman's approach does but are otherwise similar.

The Emotional Expression Approach: Smiling as the Expression of Happiness

According to the emotional expression view, a smile is the major component of a facial display associated with and caused by feelings

of happiness or joy. Anything that makes a person feel good or happy should produce smiling unless the individual wants to mask or inhibit this display. Laughing is considered to be the expression of either more intense happiness (Darwin, 1872/1965) or a particular type of happiness (Ekman & Friesen, 1975). Cultural and individual differences influence smiling both by determining the interpretation of events, which affects the cause of happiness, and by shaping display rules, which determine when it is socially appropriate to smile. But such differences do not alter people's innate and universal tendency to smile when they are happy. Thus, when a smile does occur, the message is usually happiness (Ekman & Friesen, 1975), although this may be a false message if the sender is masking another emotion with a smile or if the sender is simulating happiness for some other reason.

It is important to note that although workers in this tradition have emphasized the importance of facial expression in communication and social behavior, they have rarely studied such communication in natural social settings by studying the causes and consequences of smiling; rather, they have focused on the recognition and verbal labeling of emotions in facial expressions, generally in still photographs.

Ethological Studies:
Smiling Indicates Friendliness

A different paradigm has of necessity been used by ethologists studying nonhuman primates. These workers have used naturalistic observation as a research tool and have drawn many of their hypotheses about humans from comparisons of humans with other primates; they have concentrated on the proximate causes of smiling, its consequences for the immediate interaction, and its evolutionary functions.

Many nonhuman primates have a submissive facial display, called a grimace, a grin, or a silent bared-teeth face. The display resembles the human smile, and in all species in which it occurs, it seems to have the function of deflecting hostile behavior of more dominant animals (Hooff, 1962). In a detailed study of chimpanzees, Hooff (1972, 1973) showed that in addition to averting attacks, variations of this display were used to maintain or increase affiliative behaviors between individuals. In some circumstances dominant animals used one variety of the bared-teeth face to reassure subordinates of their nonhostile, affiliative intent. Hooff hypothesized that the human smile is evolutionarily related to the chimpanzee's bared-teeth displays and serves the same functions of deflecting hostility and maintaining friendly contact. On the other hand, according to Hooff, laughter evolved independently and is related to the primate "play face."

If human smiling is a behavioral homologue of chimpanzee bared-teeth displays, one would expect smiling to occur most in face-to-face interaction, especially where friendly intent is problematic or where social bonds are being established or renewed. The smiler's motivation may be genuine friendliness or an intent to establish friendly relations. Researchers in this ethological tradition have not been concerned with the emotions or feelings experienced by those doing the smiling.

The two approaches outlined above are not necessarily incompatible, but they have talked past each other by using different methodologies on different species to ask different questions. The present article tries to compare predictions based on smiling as the expression of happiness with those based on smiling as an indication of friendliness, since the most straightforward extrapolations from each position do lead to different predictions about the causes of smiling in social settings. We asked about the motivational state of the smiler and the conditions under which smiling is produced, and we used naturalistic observation as our methodology. We chose public settings in which we could observe people's faces, in which the two theoretical orientations would predict that smiling would occur frequently, and in which we could distinguish the two theories. Thus, for a setting to be relevant to the emotional orientation, emotionally arousing and happiness-producing events had to be frequent. To be relevant to the social orientation, social interaction had to be frequent.

Study 1: Naturalistic Observations of Bowling

Watching bowlers is an excellent way to distinguish the social and emotional hypotheses about the causation of smiling. Observations of the progress of the game and the actions of friends and teammates provide evidence about external events that might cause smiles, and observations of the bowlers' behaviors as they are smiling provide evidence about their motivational states.

According to the emotional hypothesis, bowlers should smile whenever they feel happy, for example, immediately following a spare or strike. But according to the social hypothesis, smiling should occur during social interaction, and the score obtained should be irrelevant.

To some extent, the entire game of bowling is played in a social context. Bowlers generally play with several friends or teammates with whom they talk and drink between turns and who shout encouragement, taunts, and insults after the play (see White, 1955, for a lively description). Yet during the game, the extent to which bowlers are engaged in social interaction varies greatly from moment to moment. When bowlers are facing the pins, preparing to roll the ball and watching the outcome, social interaction is minimal. It increases when they turn to face friends and is greatest when they are engaged in face-to-face interactions in close proximity to them. The social hypothesis predicts that smiling should occur most during these bouts of more intense social involvement.

Method

The bowling alley in which we made observations had 36 lanes. The lanes were set up in pairs with a scoring table centered about 4.5 meters behind the foul line and a semicircular bench defining a pit for bowlers waiting their turn. Behind the pit and a guardrail was a gallery with small tables at which spectators and bowlers might sit, watch the game, and drink.

Although there were many variations, most bowlers followed a predictable sequence. They would arise from a seat in the pit, select a ball from the ball return located between the two lanes, approach and release the ball at the foul line, stand or back up while facing the pins to see the outcome of the roll, turn 180° to face the pit, and walk toward the pit. After turning from the pins, they might show a communicative display or engage in social behavior, and they would then go back to the ball return and start the second roll. At the end of the second roll, bowlers would return to their seats or leave the pit, occasionally talking to people on the way.

We made observations of bowlers who appeared to be at least 18 years old. Lanes to observe were arbitrarily chosen from among those with an open spectator table located about 7 meters behind the foul line. If no spectator tables were available, observers arbitrarily selected a lane and observed while leaning against a wall. An observer recorded behavior from all bowlers using a selected lane for a maximum of 20 rolls of the ball from all bowlers. At the end of 20 rolls, the observer moved to another arbitrarily chosen lane. Most bowlers were unaware that they were being observed by us. Those bowlers who asked were told that we were watching their technique and their score.

The observer recorded verbal and nonverbal data about bowlers from the time they turned to face the pit after bowling until they turned away to pick up the ball after the first roll or returned to their seat, left the pit, or turned away from the observer after the second roll. The mean length of an observation period for a sample of 120 rolls was 5.5 seconds. A pattern of body and facial behavior believed by the observer to have occurred simultaneously was recorded as a unit. If an element in the display changed or if the same pattern was held for what seemed a very long time to the observer, the observer recorded another unit.

Our observational study of bowlers was replicated three times, using slightly different lists of behaviors, different observers, and different recording techniques. Over all replications we observed 1,793 rolls of the ball, based on approximately 350 different bowlers. Observers were trained by watching and recording from videotapes of people bowling. In the first replication, observers were five students in a seminar on human ethology and the two authors. We were aware of the hypotheses of the study and recorded behaviors using a brief notational scheme with pencil and paper. In the second replication, two observers naive to the hypotheses of the study watched 550 rolls of the ball and recorded behaviors by speaking code names of the behaviors into portable tape recorders, pausing between behaviors in order to indicate unit boundaries. Using this technique, observers didn't have to remember behavioral sequences as long and didn't have to look away from the research subjects to record data; they were therefore able to record more behaviors and units per observational period.

In the third replication we videotaped 155 rolls of the ball and made detailed analyses of these tapes. Recordings were taken with bowlers' awareness and permission. We set up the lights and camera at the spectator table and pretended to film for 5 minutes prior to the actual filming to acclimate subjects to

the equipment. Two observers recorded data from these tapes. As soon as both eyes of the subject could be clearly seen, the observers stopped the tape, recorded behaviors, hand-turned the tape one quarter-turn, recorded behaviors, and repeated this sequence until the subject moved out of focus or turned so that only one eye could be seen. Using this method, data were recorded at approximately two-thirds-of-a-second intervals. After this stop motion analysis, the tapes were played at least once at normal speed to validate the behaviors recorded.

We did no reliability checks on the live recording. On the analysis of the videotaped sequences the two observers agreed on 97% of the behaviors that either recorded.

We recorded the following behaviors because prior research suggested that they might be communicative and because pretesting showed that they had occurred with sufficient frequency to allow meaningful statistical analyses:

Neutral face: blank expression; mouth relaxed; head straight forward; absence of all other coded behaviors except *talked to, groom,* and *good score.*

Closed smile: corners of the mouth turned up; lips together; teeth together.

Open smile: corners of mouth turned up; lips are parted to show teeth. In Replication 1 only, smiling was coded without distinguishing between closed- and open-mouth smiles.

Laugh: mouth open, corners of mouth sometimes turned up; laughter accompanying open mouth.

Tight lips: lips compressed tightly; mouth in straight line; teeth probably clenched.

Look: gaze fixed on another person.

Look down: gaze directed at floor.

Look away: head turned off body axis, gaze not directed at others in group.

Talk: vocalization by subject to another person.

Talked to: vocalization directed to the subject.

Groom: subject preening, scratching, or rubbing any part of his body or face.

Face cover: one or both hands covering facial features for several seconds. This was not recorded in Replication 2.

Head shake: a continuous horizontal movement of the head, usually repeated several times.

Ham: a nonspontaneous, exaggerated facial or body expression apparently intended to communicate; for example, "funny" faces, sticking out tongue, wrinkling nose, jumping up and down, dancing a "jig."

Positive exclamations: spontaneous and often exaggerated actions or words that the observer believed corresponded to a pleasant experience or one during which the individual felt pleasurably excited. For example, a leap and squeal of joy after a strike.

Negative exclamations: spontaneous and often exaggerated actions or words that the observer believed corresponded to an unpleasant experience. For example, swinging the fist across one's body, stamping one's foot, or swearing after missing the pins. Exclamations were more spontaneous, less exaggerated, and shorter, and appeared to be less intentially com-municative than hamming, with which they might be confused.

Good Score: a strike or spare.

Sequential Analysis

In order to understand the causes of smiling, it is necessary to examine the events with which it is temporally associated. If smiling often followed an external event in the smiler's environment, it is possible and even likely that the event caused the smile. If smilers often performed other behaviors while smiling, it is likely that the motivation underlying the other behaviors is also underlying the smiling.

Whether we consider two events or behaviors temporally associated depends on the time unit we select; the meaning of *simultaneous* depends on temporal resolution. In Replication 1 we have considered two behaviors as temporally associated or co-occurring if the original observer thought that they had occurred simultaneously, that is, placed them in the same behavioral unit, or if the observer placed them in adjacent behavioral units. Replication 2, using tape recorded data collection, and Replication 3, using analysis of videotapes, had finer temporal resolution. Therefore, to make all data analyses comparable, we considered two behaviors as co-occurring if they occurred within 3 behavioral units of each other in Replication 2 and within 8 behavioral units of each other in Replication 3. This means that we considered two behaviors as temporally associated if they occurred within about 4 seconds of each other.

Because the frequency of co-occurrence is biased by the frequency of each behavior, Yules Q or gamma is the appropriate measure of association to use. We use this statistic rather than the more familiar phi correlation because we considered a positive or negative association between two behaviors as perfect if the more frequent behavior always or never occurred with the less frequent behavior (Blalock, 1972, pp. 298–299).[1]

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[1] The formula for gamma in this research is as follows. Let A = the frequency of co-occurrence. T = total behavioral units; this is the total number of opportunities for co-occurrence. Ant = the frequency

Results

The data were stable and the co-occurrence of smiling with other behaviors is similar across the three replications. The mean Pearson correlation between columns in Table 1 is .80 ($p < .001$).

The social hypothesis leads us to expect that bowlers will smile when they are socially motivated independently of emotional experience. Table 1 provides evidence of this. Bowlers were more likely to smile when they were engaged in social contact, for example, when looking at their friends ($M \gamma = .71$), and less likely to smile when they were temporarily avoiding social contact for some reason and were looking at the ground or away from their friends ($M \gamma = -.56$). In addition, bowlers showed a tendency to smile more when they were talking to friends or being talked to by them ($M \gamma = .20$).

Smiling, especially open-mouth smiling, also occurred with playful behaviors; laughter ($M \gamma = .23$ over all smiles; $M \gamma = .80$ for open-mouth smiles), hamming ($M \gamma = .33$ for all smiles; $M \gamma = .47$ for open-mouth smiles), and face-covering ($M \gamma = .34$ for all smiles; $M \gamma = .93$ for open-mouth smiling). At the bowling alleys, open-mouth smiling occurred when bowlers were being socially playful. Since nonsocial playfulness rarely occurred in this setting, we cannot tell if the social or the playful motivation was a more important determinant of open-mouth smiling.

The happiness hypothesis leads us to expect that bowlers would smile more after playing well and bowling a good score, but this was not the case. The association between smiling and scoring a spare or strike was weak ($M \gamma = .13$). Of the 1,793 rolls for which we collected data, 448 were spares or strikes. Bowlers smiled 30% of the time after good scores and 23% otherwise. Other support for the happiness hypothesis is mixed. In general, smiling showed weak associations with the behaviors that we had identified as subtle indicators of negative affect and stronger associations with larger scale emotional displays. Thus, smiling had little association with the subtle cues of grooming and head shaking. Smiling had a substantial negative association with the tight-lip display, which our observations had led us to believe was an indicator of anger, frustration, and perhaps determination. It is a component in the traditional anger display (Ekman & Friesen, 1975). However, the negative association could have been partly caused by the physical difficulty a bowler would have smiling and lip pressing simultaneously (and the difficulty coders would have distinguishing two behaviors in the mouth region) as well as by the emotional incompatibility of smiling and lip pressing.

On the other hand, the spontaneous emotional displays we have termed positive and negative exclamations showed substantial associations with smiling. When bowlers were communicating surprise and glee, generally after getting a good score, they smiled ($M \gamma = .49$); when they swore and showed other signs of disappointment and anger, generally at not getting a good score, they failed to smile ($M \gamma = -.49$). Since smiling showed no association with score, which is the likely cause of bowlers' emotional experience, these data suggest that when bowlers were attempting to communicate their happiness through positive exclamations, they used smiles as part of the communication; when they were experiencing positive emotions but were not attempting to communicate them, however, smiling did not covary with other subtle behavioral indicators of their emotional state.

Several problems limit confidence in the conclusions one can draw from these co-occurrence data. As we have suggested above, the degree of temporal co-occurrence between behaviors may reflect as much their physical

of the antecedent behavior; this is the maximum number of times it could have co-occurred with a subsequent behavior. Sub = number of behavioral groupings (i.e., two behavioral units in Replication 1, three units in Replication 2, and eight units in Replication 3) in which a subsequent behavior occurred; this is the maximum number of times it could have co-occurred with an antecedent behavior. Then B = Ant − A; C = Sub − A; D = T − A − B − C; $\gamma = [(A \times D) - (B \times C)]/[(A \times D) + (B \times C)]$. Since the gamma based on Behavior X preceding Behavior Y is not necessarily the same as Y preceding X, we used the mean of these two measures in all our analyses.

Table 1
Temporal Associations (Gamma) of Smiling and Other Behaviors

| | Replication | | | | | | |
| | 1 | 2 | | 3 | | *M* | |
Behavior	All smiles	Closed smile	Open smile	Closed smile	Open smile	all smiles[a]	*t*
Neutral face	−77	−52	−88	−70	−93	−76	10.5
Closed smile	—	—	−19	—	05	−07	—
Open smile	—	−19	—	05	—	−07	—
Laugh	−48	07	91	−06	70	23	.90
Ham	20	08	44	43	50	33	4.09
Look at	70	63	88	53	83	71	11.14
Look down	⎰ −59	−48	−82	−40	−66	−59	8.10
Look away	⎱	−56	−51	−38	−56	−52	13.95
Talked to	42	05	44	37	−26	20	1.50
Talk	37	08	41	07	−02	18	2.09
Groom	−47	01	−26	−14	04	−16	1.75
Tight lip	−79	−52	−68	−33	−63	−59	7.55
Face cover	28	—	—	−18	93	34	1.07
Head shake	−18	17	−07	12	15	04	.55
Positive exclamation	24	23	71	72	56	49	4.53
Negative exclamation	−65	−59	−40	−16	−64	−49	5.22
Good score	07	37	29	01	−09	13	1.50

Note. Decimal points have been omitted.

[a] In this table significance tests have not been performed on the individual gammas, since the units on which they are based were not independent of each other. They are based on 5,527 overlapping 4-second periods in which two behaviors could co-occur, spread over 1,793 rolls of the ball and over approximately 350 different bowlers. The *t* tests performed on the mean gammas are based on five observations and test whether smiling is associated with the other behaviors reliably over the different replications and types of smiles.

compatibility as their similarity in underlying motivation or external causation. For example, since smiling, laughing, talking, and compressing one's lips are all behaviors done by the mouth, their mutual co-occurrence is limited. Similarly, the neutral display, by definition, cannot co-occur with other behaviors. A second problem could be a result of observer errors. Faced with a rich and complex event, observers' errors tended to be omissions; our training procedures showed that observers were more likely to ignore behaviors that did occur than to record behaviors that did not occur. What might be termed a climax error may be characteristic of event sequences in which observers underreport low intensity forms of a behavior that gradually change to a climax form of the same or another behavior. For example, it is possible that smiling might be underreported in the sequences leading to laughter, hamming, and positive exclamations, while tight lips and

grooming might be underreported in the sequences leading to negative exclamations.

A third problem is more conceptual. Our research strategy has been to infer the messages of smiling by examining other behaviors with which it occurs, that is, marker behaviors. Our beliefs about the significance of these other behaviors were based on the prior literature on nonverbal communication, on informal observation in our research setting, and on intuition. More systematic analysis of the patterns of co-occurrences among marker behaviors could provide direct evidence on the significance of marker behaviors and might provide deeper insight into the messages of smiling.

Principal Components Analysis

One partial solution to these problems is to analyze the similarities in co-occurrence that pairs of behaviors had with other behaviors

rather than analyzing only the temporal association between pairs. For example, if lip tightening and closed-mouth smiling were equivalent but alternative behaviors, an analysis of temporal association would show that they never co-occurred, but an analysis of their similarities in co-occurrence would show that they occurred in exactly the same contexts. Following Hooff's logic (1973), we started with the assumption that to the extent that a pair of behaviors occurred in the same contexts, that is, to the extent that they had similar co-occurrences with other behaviors, they also shared underlying motivations or external causes. The Pearson correlation between rows in a matrix of gamma scores (our measure of co-occurrence) is one measure of the extent to which the pair of behaviors represented by the rows had similar co-occurrences with each other behavior, including co-occurrences with themselves. Because the three replications of our basic study resulted in three estimates of the co-occurrences between each pair of behaviors, we took the median of these three as our best estimate of the co-occurrence. The Pearson correlation between rows was conducted on this matrix.[2]

One can factor analyze this correlation matrix. Table 2 is a varimax rotation of the principle components analysis of this matrix. The five factors that emerged prior to an eigenvalue falling below 1.0 represent 86% of the variance in the original matrix. An examination of the factor structure provides evidence both about the pattern of co-occurrences and the underlying motivations represented by the marker behaviors and about the association of closed- and open-mouth smiling with these underlying motivations.

On what factors did smiling load highly? Factor 3 seems to represent a social motivation. Talking, being talked to, looking at another, and not looking down or away all load highly on this factor. Closed-mouth smiling has its highest loading on this factor, and in addition, open-mouth smiling and laughing both loaded highly here. This result supports the previous analysis and clearly suggests the social motivation underlying both closed- and open-mouth smiling and laughing.

Table 2

Component Analysis of Similarities in Co-occurrence

Behavior	Factor				
	1	2	3	4	5
Tight lip	*-87*	02	-34	08	-03
Head shake	*-85*	-24	13	23	-01
Laugh	*84*	-00	31	18	-30
Face cover	*75*	27	05	08	42
Open smile	*60*	32	44	-24	43
Good score	18	*92*	02	-23	-19
Negative exclamation	-23	*-91*	-09	-19	-11
Positive exclamation	-08	*70*	30	*-54*	06
Talk	13	-10	*92*	-04	-11
Talked to	12	11	*87*	-19	08
Closed smile	10	44	*64*	-16	29
Look at	31	41	*63*	-20	47
Look down	-57	-14	*-61*	30	-05
Ham	08	08	27	*-89*	15
Groom	-34	-05	-08	*75*	-14
Neutral face	-25	24	-07	17	*-81*
Look away	-09	-22	-47	16	*-67*

Note. Decimal points have been omitted. Loadings greater than or equal to 60 are shown in italics.

Smiling shows a complex pattern of relationships with the emotional displays. Factor 2 represents the explosive emotional displays associated with extreme scores: good scores and positive exclamation loaded highly, and

[2] In Replication 1, closed-mouth smiles were not distinguished from open-mouth smiles and looking down was not distinguished from looking away. In computing the matrix of median gammas, the undifferentiated categories of Replication 1 were generally averaged with each differentiated category of Replications 2 and 3. For example, the association between smiling and grooming in Replication 1 contributed in the final matrix to both the association of closed-mouth smiling and grooming and the association of open-mouth smiling and grooming. However, in a few cases closed and open smiles and looking down and away had substantially different associations with another behavior in both Replications 2 and 3 (mean difference in gamma > .30). In these cases, Replication 1 was ignored in computing the final measure of association. Specifically, Replication 1 was ignored in computing the median relationship of closed- and open-mouth smiling to laughter and to face cover.

negative exclamations loaded negatively. The association of closed-mouth smiles with this set of behaviors may reflect the role of closed-mouth smiling in the communication of emotion. Factor 1 seems to represent the contrast between affect and playfulness. The tight lip, head-shake, and looking-down displays cluster at one pole; and laughter, face covering, and open-mouth smiling cluster at the other. This factor may reflect the incompatibility of genuine playfulness with feeling bad.

Factors 4 and 5 are especially difficult to interpret. Factor 4 primarily represents the contrast between hamming and positive exclamations, on the one hand, and grooming, on the other. Factor 5 may indicate expressiveness. The neutral and looking-away displays are at one extreme, and open-mouth smiling and face covering are at the other.

In summary, both the temporal co-occurrence of smiling with other behaviors and the factor analysis of similarities of co-occurrence suggest that bowlers smiled when they were being social, when they were being playful, or when they were otherwise communicating an emotional statement to an audience. Both closed-mouth and open-mouth smiling shared a nonemotional, social motivation. In addition, open-mouth smiling was similar to laughter in adding a playful motivation; to the extent that one cannot be playful and at the same time distressed, angry, or disappointed, open-mouth smiling was incompatible with negative affect.

Study 2: Bowlers Facing the Pins or Their Companions

One might dismiss our failure to find a strong association between smiling and emotional experience in Study 1 with the claim that bowlers were masking their emotional experiences; they hid the joy or disappointment they felt in order to appear modest or sportsmanlike. To meet this objection we made observations of people who were bowling alone and were therefore under no pressure to mask their emotions. Lone bowlers rarely showed any facial displays or other gestures but instead maintained a generally neutral face. The most common expressions seen were relatively

Table 3

Percentage of Bowlers Smiling According to Bowling Score and Social Focus

	Score		
Social focus	Good	Not good	Total
Yes	42	28	31
No	4	3	3
Total	46[a]	31[b]	—

Note. $N = 116$.
[a] $n = 26$.
[b] $n = 90$.

antisocial or negative—looking down, tight lips, and negative exclamations; they rarely smiled. However, one may object to these data, since people who bowl alone may be the type of person who is unexpressive in all circumstances.

Therefore, to further examine the social and emotional messages of smiling, we looked at bowlers when they were facing the bowling pins and reacting to their rolls, and at the same bowlers when they turned to face their friends. The social hypothesis would lead us to expect very little smiling as bowlers faced the pins, since this is a relatively nonsocial setting. The emotional hypothesis would lead us to expect that bowlers would smile after rolling a good score and would engage in behaviors revealing negative affect after bad scores, regardless of their social orientations. When bowlers roll a good score and remain facing the pins, they should feel happy and should not need to mask or hide the expression of this emotion, since they believe that they are not being observed.

Method

An observer knelt on a platform among the pin setting equipment at the end of the bowling alley behind the bowling pins and watched bowlers through binoculars as they finished their roll. The observer was 19.2 meters from the bowlers and observed through a narrow slit in the facade of the pin setting equipment. The observer was invisible to bowlers. As bowlers finished their roll and stepped back while watching its outcome, the observer recorded characteristics of the bowler and the behaviors listed above. Data were recorded from the moment the bowler stepped into view until he turned toward

the pit. Simultaneously, a second observer positioned as in Study 1 recorded behaviors in the standard way after the bowler turned to face friends in the pit. One hundred and sixteen rolls from 34 bowlers were observed from both positions (behind the pins and facing the pit).

Results

As shown in Table 3, bowlers were generally unexpressive while facing the pins, in comparison with their behavior when they faced their friends in the pit. Smiles were particularly rare. In 116 observations, bowlers smiled 36 times when facing friends but only 4 times while facing the pins, $t(115) = 6.25$, $p < .001$. Smiling was unrelated to how well they bowled. Only one of the pin-facing smiles was after a good score, although bowlers in this sample rolled 26 strikes or spares. These data clearly support the social hypothesis. People rarely smiled in nonsocial settings, regardless of emotional experience.

Study 3: Smiling by Fans at a Hockey Game

Hockey at Cornell University is probably the most important school sport. Students, faculty, and townspeople line up overnight to get season tickets. In 1977, Cornell's team had finished its regular season first in the Ivy League and was in the playoffs for the Eastern College Athletic Conference Championships. On March 8, 1977 the team faced Rensselaer Polytechnic Institute in the quarter-final at Cornell. As might be expected, the game was sold out, mainly to enthusiastic Cornell fans. Given this situation, the emotional hypothesis about the causation of smiling would predict that Cornell fans would smile more when the hockey match was going well for Cornell than when it was going well for the opposing team. On the other hand, the social hypothesis would predict that fans would smile more when socially interacting with other fans than when watching the game.

Method

A photographer sat in the stands during the hockey game and, using a telephoto lens, took pictures of the spectators across the ice from him (about 30 meters away) immediately following events favor-

Table 4

Percentage of Spectators Smiling According to Valence of Hockey and Social Involvement

| Social involve-ment | Valence of play for home fans | | | | | |
| | Good | | Not good | | Total | |
	%	n	%	n	%	n
Yes	27	59	22	165	23	224
No	12	1,258	2	2,244	6	3,502
Total	13	1,317	3	2,408	7	3,726

able, neutral, or unfavorable to Cornell's chances of winning the hockey game. About 220 people were photographed at each exposure ($M = 223$; $SD = 21.8$). The photographer used a prefocused camera on a tripod and took pictures while watching the hockey game in order to be uninfluenced by the behavior of his subjects as he was photographing them. Photographs were taken after (a) goals for Cornell or the opposing team, (b) penalties called on Cornell or the opposing team, (c) face-offs, before the puck came into play, and (d) time-killing passes of the puck at center ice. Cornell goals and opposing-team penalties were considered events favorable to Cornell, the opponent's goals and Cornell penalties were considered unfavorable, and face-offs and center-ice passes were considered neutral. The section of the stands that was repeatedly photographed mainly contained season ticket holders and was filled with Cornell fans. There were few opposing fans in the entire arena, and they were segregated in another area.

Each transparency was coded by a person naive to both the hypothesis of the study and the events preceding the photograph. Five randomly selected transparencies were then recoded by a second person to check reliabilities. The transparencies were first scanned for social units, which were defined as a group of two or more spectators, at least one of whom was turned towards the other or others in the group. The two independent coders agreed on 73% of the social units that either identified. Each member of a social unit was defined to be socially involved with others in that unit, and all other spectators were defined to be socially uninvolved. The transparencies were next coded for smiling. The two coders agreed on 73% of the smiles that either identified, 69% for smiles within social units, and 74% for other smiles.

Results

Because the results involving neutral and bad events didn't differ substantially from each other, they have been combined in the analyses that follow. Table 4 shows the per-

centage of fans smiling who were or were not part of a social unit following events that were good or not good for the Cornell hockey team.

We coded a total of 3,726 faces in 16 photographs. Over all photographs, the probability of any one of these faces smiling at the moment that the picture was taken was .069. Some data supported the emotional hypothesis. Spectators were more likely to smile following events favorable to the home team (13%) than following neutral or bad events (4%; $\gamma = .60$; $N = 3,726$; $p < .001$). Some data supported the social hypotheses. Regardless of the valence of the events that preceded the photograph, spectators were more likely to smile if they were members of social units (23%) than if they were not (6%; $\gamma = .66$; $N = 3,726$; $p < .001$). The effects of being socially involved on smiling were stronger following bad and neutral events ($\gamma = .85$) than following good ones ($\gamma = .45$, $p < .01$), perhaps because the base rate of smiling was lower following bad events.

Study 4: Smiling, Social Interactions, and the Weather

People feel happier on days when the weather is nice. Given this assumption, the emotional orientation would lead us to expect that people walking outdoors would smile more in pleasant than unpleasant weather. As they walk, they can either be socially involved with someone or not. The social orientation would lead us to expect that people would smile more if they are socially involved but that the weather alone should not influence the frequency of smiling.

Method

A single observer made observations of pedestrians twice at each of four public walkways in Ithaca, New York in September and October 1977. Each site was observed once during pleasant weather, when the temperature was between 50 and 70° F. and the sky was sunny or partly sunny, and once during unpleasant rainy weather. Pairs of observations were made at approximately the same time of day and were made within 3 weeks of each other. A total of 663 subjects were observed in the eight observation periods.

Table 5

Percentage of Pedestrians Smiling According to the Weather and Social Interaction

| Social interaction | Weather | | | | Total | |
| | Good | | Bad | | | |
	%	n	%	n	%	n
Yes	61	61	57	60	59	121
No	12	264	5	288	8	552
Total	21	325	14	348	—	—

At the site, the observer selected two reference marks about 10 meters apart on the sidewalk to indicate the limits of observation. The next pedestrian approaching the starting mark was selected as a subject. If pedestrians were walking in pairs or larger groups, the person on the extreme left or the person on the extreme right was alternately selected as the subject for that group, before the group passed he starting mark. Subjects were observed for the 8 to 12 seconds it took them to walk between the two reference marks. If they talked to anyone, greeted anyone, or were talked to by anyone at any time during the observation period, they were classified as socially interacting during that period. If they smiled at any time during the observation period, they were classified as smiling during the observation period. Reliability of the smile classification, based on a second observer's judgments of 100 pedestrians, was high ($\phi = .86$).

Results

Table 5 shows the cross classification of social interaction and smiling among pedestrians during days with good and bad weather. These results show that pedestrians are no more likely to engage in social interaction on nice days than on bad ones (19% vs. 17%, $\phi = .02$). They were slightly more likely to smile on nice days than on bad ones (21% vs. 14%, $\phi = .10$, $p < .01$) and were very much more likely to smile if they were conversing with or greeting someone than if they were not (59% vs. 8%, $\phi = .54$, $p < .001$). The effect of social interaction on smiling was slightly stronger on bad weather days than on good days ($\phi = .58$ vs. .47, $z = -1.41$, $p < .10$), but this interaction was minor compared to the main effect of social interaction and may not replicate.

We conducted an extensive pretest in which 1,489 subjects were observed at six sites on

the Cornell campus in the summer of 1977. Good weather was defined as between 65° F. and 75° F. with low humidity, whereas bad weather was over 85° F. with high humidity. Subjects were observed as long as they remained in sight, about 10–20 seconds, and observation times were not standardized across sites. In this pretest, subjects were again slightly more likely to smile on nice days than on unpleasant ones ($\phi = .13$, $p < .01$) and were much more likely to smile while socially engaged than when not ($\phi = .56$, $p < .001$). Here, however, social interaction had similar effects on good weather and bad weather days ($\phi = .58$ vs. .54, $z = .89$, $p > .10$).

In both comparisons, social interaction was thus a much more powerful predictor of smiling than was the weather. In the main study, variations in social interaction accounted for 29% of the variance in smiling, whereas variations in the weather and the positive and negative emotions they may have produced accounted for about 1% of the variance in smiling.

Discussion

The Social Hypothesis

Both the present and earlier research provide strong evidence that social involvement is a major cause of smiling, independent of the smiler's emotional state. In each of the four studies described above, smiling was strongly associated with social interaction: talking to and looking at others in Study 1, facing fellow bowlers in Study 2, orienting toward other fans in Study 3, and talking to another person in Study 4. Other researchers have also found that smiling often occurs in a social context. Almost from its first appearance, smiling is socially produced and has social consequences. Human infants, from the age of 1 to 5 months, smile most in response to the human voice and the human face or abstractions of it (Sroufe and Waters, 1976). These smiles seem to be a major determinant of the bond between an infant and its caretaker (Fraiberg, 1977; Spitz & Wolf, 1946). Among nursery school children, smiles are likely to occur in the context of other social

behaviors such as pointing, giving, receiving, and talking (Blurton-Jones, 1972). When nursery school children approach a stranger, they often smile, and they are more likely to approach when the stranger smiles and talks to them (Connolly & Smith, 1972). In addition, the smile appears to be a universal component of greetings (Kendon & Ferber, 1973; Eibl-Eibesfeldt, 1972). Even when people smile in response to humorous or other nonsocial stimuli, they smile more in the presence of other people than when they are alone (Mackey, 1976; Leventhal & Mace, 1970).

It could be argued that positing a separate social cause for smiling is a theoretical extravagance. According to this view, the presence of others is just one of the many events that make people happy, and apparent social smiling is mediated by the pleasant emotions the smiler feels in the presence of others. This is undoubtedly true on occasion.

However, there are several reasons to believe that many smiles have purely social causes independent of happiness. The first is parsimony. We need not assume that happiness is a cause when we have evidence of a strong relationship between social stimuli and smiling, but no evidence of a mediating emotion. A theory of friendliness displays, based on independent comparative data, can account for the empirical relationship. The component analysis of Study 1 showed a social, nonemotional motivation behind some smiling (Factor 3 in Table 2): both closed- and open-mouth smiling occurred in the same contexts as each of the social behaviors we recorded at a bowling alley. These in turn were independent of both gross and subtle emotional displays of happiness, disappointment, and anger. This evidence of purely social smiling exists even though smiling has an emotional component under some circumstances (Factors 1 and 2 in Table 2).

The existence of smiles in uncomfortable social settings is further evidence against the hypothesis that social smiles are mediated by happiness. Repeated viewings of some of our bowling videotapes convinced us that some smiling was done to apologize for an especially clumsy performance or for poor bowling, such as dropping the ball before bowling

or bowling a gutter ball immediately after bowling a strike. To examine this possibility more systematically, we have started looking at facial expressions in uncomfortable social settings. If smiling evolved from primate appeasement displays, we would expect that in humans some smiling should occur when a person is trying to placate or appease another, for example when he or she has made a mistake or has violated a social norm and is apologizing for it. An exploratory field experiment suggests that subjects smile more in an appeasement than in a control condition. In the appeasement condition, customers in a store were made to think that they had made a mistake when they interrupted a clerk busy with paperwork who told them "I'm not working here. She (another clerk) will help." In the control condition, customers were made to think that no mistake had been made ("Fine, I'll get it for you, and she will ring it up"). Customers apologized more in the appeasement (11%) than the control (0%) condition. More to the point, customers smiled more in the appeasement condition (28%), when they were presumably trying to rectify a mistake, than in the control condition (5%, $\gamma = .77$; $n = 99$; $p < .001$).[3]

Ekman (1972) also notes that people often smile when experiencing an unpleasant emotion in the presence of others, although he interprets the smile as a mask for a socially inappropriate facial expression that the emotion would cause rather than as an appeasement display. A question for future research is to determine whether an appeasement or a masking hypothesis can better account for the occurrence of smiling in tense or uncomfortable social situations.

The detailed analysis of patterns of behavior in which smiling is embedded provides additional evidence that social smiling need not be mediated by happiness. For example, Kendon and Ferber (1973) have carefully described the behavior in a greeting. They divided the greeting into three stages, a distance salutation in which the participants establish their readiness and willingness for interaction, an approach phase in which one walks toward the other (or both do), and a close salutation that is a prelude to conversation or other social interaction. During the

distance salutation, the greeters orient their bodies toward each other, look at each other, and show a greeting gesture such as a head toss, an eyebrow flash, a wave, or a verbal greeting. During the approach phase they decrease the amount they look at each other, until immediately prior to the close salutation, when all participants looked at and then talked to each other. Clearly the greeters were regulating their social contact during the greeting, first agreeing to it, then postponing it, and finally engaging in it when their physical separation made it convenient.

Significantly for the present argument, smiling almost invariably occurred in both the distant and close salutation, when greeters were showing a willingness to greet each other and establish or reaffirm their relationship. Smiling occurred much less frequently and intensely during the approach phase, when the greeters were showing a temporary withdrawal from social contact by looking away from each other. Smiling thus varied with the intensity of social contact. Since emotions are often regarded as diffuse with a gradual decay, it is difficult to account for the rapid and asymmetrical shifts in smiling during a 10–20 second greeting by referring to shifts in happiness.

Through this literature review, we have tried to establish that social involvement is a major cause of smiling and that happiness does not seem to be a necessary mediator. Why do people smile in the presence of others? Drawing on comparisons of humans with other primates, Hooff (1972) argues that most human smiling is affinitive, used in the expression of sympathy, reassurance, or appeasement, that is, that the smiler's motivation is to insure the establishment and maintenance of friendly interaction. The message might be paraphrased "I am friendly" or "I would like us to be friendly for a while." This may occur when friendliness is highly probable, as when two old friends greet each other after an absence, or when friendliness is problematic, as when a client interrupts a conversation between two professionals to ask one of them a question. The smile is an evolu-

tionarily designed signal to smooth interaction among members of a species who must cooperate in group living.

The Emotional Hypothesis

In our studies smiling had a weaker and more erratic association with happiness than it had with social interaction. Although people smiled when shouting, jumping, and gesturing after bowling a spare or a strike or when cheering their hockey team's goals, they did not smile much when they had gotten a good bowling score and were alone or had not yet turned to face their friends, or when they were walking down the street alone on a nice day. Given the very strong link between smiling and the experience of pleasant emotions posited by both the popular culture and the 100-year-old Darwinian tradition, our failure to document this link convincingly demands explanation. We will discuss three attempts to reconcile our results with the happiness hypothesis.

First, we may have found more smiling when people were social than when they were happy because our independent variables were not equated for strength. If bowling, hockey games, and walks on fine days do not produce strong pleasant emotions, they could not be expected to produce much smiling either. We believe that in general, smiling as a display of happiness is relatively infrequent in daily life, partly because the strong emotions that may be needed to elicit it are also rare. However, this is not a plausible explanation for the present results. We picked settings and activities that were likely to produce variations in positive and negative emotions. Our observations suggest that strong positive and negative emotions were produced in these settings, but that they were expressed without a consistent relationship to smiling. The positive and negative exclamations during bowling were one indicator of the strength of the emotions produced. Not getting a spare or a strike led to fewer positive exclamations and more negative exclamations, head shakes, and tight-lipped displays. Thus variations in score produced variations in emotional expressions. Although we did not systematically collect data on emotional displays among

hockey fans or among pedestrians, our casual observations suggest that hockey fans expressed their excitement, joy, and approval by jumping up and down, clapping, and screaming, whereas pedestrians celebrated spurts of pleasant weather, after days of Ithaca's drizzly gloom or oppressive heat and humidity, by walking with a lilt, whistling, and humming, not by smiling.

A second possibility is that although smiling did indeed have a strong association with happiness, our subjects masked their emotional expressions according to cultural display rules, to confuse their audiences, or to comply with felt normative pressures (Ekman, 1972). They refused to smile when they felt good and used smiling as a mask for negative emotional expressions when they felt bad. However, this too is an unlikely explanation for our results. In both the bowling and hockey settings, subjects were very expressive, probably much more so than in other settings of daily life. For example, the frequency of positive and negative exclamations among bowlers and the strong association of positive exclamations with good scores attest to the freedom of this setting from constraints on emotional expression. In addition, as mentioned earlier, bowlers smiled least when they were alone or were facing away from fellow bowlers and were thus under the least pressure to use display rules.

A third reason why our results linking smiling and happiness were not as strong as we had expected is that we may have been misled by the phrase *emotional expression*. Perhaps because they have underemphasized the functions of emotional displays, earlier commentators, including Darwin (1872/1965) and Ekman (1972), have used the phrase *expression* to mean the outward manifestation of an internal state. While this definition is correct, it is incomplete. To the extent that smiling is linked with happiness, it is an evolutionarily adapted signal that informs other members of the species about the sender's emotional state in order to influence their behavior. Thus, we should expect smiling, like other primate emotional displays such as fear (appeasement) or anger (threat), to be shown to a recipient and to be less frequently seen in the absence of an audi-

ence. This interpretation is consistent with
our data. Smiling had its strongest associa-
tion with emotion-producing conditions when
subjects were communicating emotions in the
presence of others through additional displays
like positive and negative exclamations, but it
was only weakly associated with emotion-
producing conditions when subjects were so-
cially uninvolved. These tentative results sug-
gest the hypothesis for further research that
emotional displays, in general, should be
more frequent and more intense in the pres-
ence of others, although this trend could be
modified by display rules (Ekman, 1972).

A Comparison of the Social and Emotional Hypotheses

The social and emotional hypotheses about
the causation of smiling are not incom-
patible with each other. As we have sug-
gested, social contact may sometimes produce
happiness, which in turn may lead to smiling.
In addition, people experiencing happiness
may show it more in the presence of others.

It is also possible that emotional and social
motivations both independently produce fa-
cial displays involving what we have termed
a smile, but the morphology of the displays
may differ. One possibility is that the mouth
region has a different shape when expressing
happiness, friendliness, or appeasement. Bran-
nigan and Humphries (1972) and Grant
(1969) have described several different
smiles. Our own attempts to distinguish
closed- from open-mouth smiles suggest that
they have different underlying motivations,
with the closed-mouth smile more purely so-
cial and the open-mouth smile more playful
and possibly more emotional. Moreover, even
if the mouth is the same, other components
of the face may differ. The whole face, rather
than just the smile per se, carries information
about emotion (Ekman et al., 1972; Ekman,
Friesen, & Tomkins, 1971). Although the
smiling mouth may be the most salient com-
ponent of a happiness display, other com-
ponents may often co-occur and differentiate
happiness, friendliness, or appeasement
smiles. Further research on facial displays
needs to move to a finer level of description
and categorization in an attempt to differ-

entiate the varieties of smiles and facial dis-
plays. Ekman and Friesen's recent work
(1978) is a step in this direction.

A Comparison of the Ethological and the Expressive Traditions

The ethological approach to nonverbal com-
munication, from which the social hypothesis
derives, differs from other approaches in sev-
eral ways. Most important, it has remained
firmly wedded to evolutionary theory and,
as a result, has stayed concerned with the
functions of nonverbal displays and their
social consequences. This concern with func-
tions and consequences was clearly present
in Darwin's original work (1872/1965; see
his discussion of the principle of antithesis),
but was lost as the study of emotional expres-
sion passed through experimental psychology.
The expressive approach to nonverbal be-
havior, from which the emotional hypothesis
about smiling derives, has focused on the cor-
respondence between individuals' internal
states and their facial and other expression.
As a result it has often embedded the study
of nonverbal behavior in individualistic psy-
chology by treating individuals as socially
encapsulated. It is true that the expressive
approach has studied communication in the
limited sense of establishing that information
about emotions can be transmitted through
facial expression. With its almost exclusive
reliance on the recognition experiment, how-
ever, this approach has not shown that people
use information from facial expressions in
daily life.

The effects of this neglect, while perhaps
unintentional, are large. Ekman et al.
(1972), after reviewing more than 100
studies on the facial expression of emotion
published in the 100 years since Darwin's
original work (1872/1965), found only a few
that investigated causation or production of
emotional displays and *none* on the effects of
emotional expression on subsequent social
interaction.

In contrast to the expressive approach, the
ethological approach to human nonverbal be-
havior treats the individual as part of a social
network and examines the interactions be-
tween people and the effects of nonverbal be-

havior on others. By studying usage, this approach guides investigators toward a careful, descriptive analysis of the situations in which smiling occurs. The types of situation we studied were chosen to compare the emotional and social hypotheses about the causes of smiling, but we, along with others, have not looked at its effects. Indeed, we know of no research on human nonverbal communication from any tradition that has simultaneously studied the social and motivational causes, the morphology, and the social consequences of a human display, as Hooff has done with chimpanzee bared-teeth displays. This holistic approach is the direction, we think, that future work on human nonverbal communication should take.

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