

# A Study of Laughter and Dissociation: Distinct Correlates of Laughter and Smiling During Bereavement

Dacher Keltner  
University of California, Berkeley

George A. Bonanno  
Catholic University of America

Laughter facilitates the adaptive response to stress by increasing the psychological distance from distress and by enhancing social relations. To test these hypotheses, the authors related measures of bereaved adults' laughter and smiling 6 months postloss to measures of their (a) subjective emotion and dissociation from distress, (b) social relations, and (c) responses they evoked in others. Duchenne laughter, which involves orbicularis oculi muscle action, related to self-reports of reduced anger and increased enjoyment, the dissociation of distress, better social relations, and positive responses from strangers, whereas non-Duchenne laughter did not. Lending credence to speculations in the ethological literature, Duchenne laughter correlated with different intrapersonal and interpersonal responses than Duchenne smiles. Discussion focuses on the relevance of these findings to theories of positive emotion.

It was a strange laugh—nothing funny had happened, after all—and yet pleasant and infectious. It was a challenge to Tamina to forget her anxieties, it was a promise of something vague—joy perhaps, or peace.

—M. Kundera, *The Book of Laughter and Forgetting*

Why do people laugh during bereavement? The possible answers to this question are as varied as the contexts in which laughter occurs. People laugh during play, trauma, exhilaration (Ruch, 1993), and aggressive encounters (Van Hooff, 1972) and even to express superiority (Darwin, 1872) and to subvert power structures (Arendt, 1969/1986). Heterogeneous in its forms, laughter has also been claimed to serve varied functions, as hinted at in the quote above: People laugh to release excess nervous "energy" (Freud, 1928/1959), to facilitate learning (Rothbart, 1973), and to enhance social bonds (Coser, 1959). In spite of laughter's centrality to social life, a study has yet to document the different kinds and functions of laughter.

We carried out the present study to address three questions concerning laughter. First, what are the intrapersonal and interpersonal correlates of laughter during times of acute distress? Theories of humor and positive emotion led us to hypothesize

that laughter accompanies the dissociation from distress and enhances social bonds. Second, are there different kinds of laughter? Laughter is a heterogeneous category of behavior, much like smiles (Duchenne de Bologne, 1862; Ekman & Friesen, 1982; Frank, Ekman, & Friesen, 1993). In the current study, we addressed whether the distinction between Duchenne smiles, which include the movement of the orbicularis oculi muscle and relate to positive emotion and interpersonal consequences, and non-Duchenne smiles (Duchenne de Bologne, 1862; Frank et al., 1993) also helps account for different forms of laughter. Third, do laughter and smiling differ? Ethologists have proposed that laughter and smiling originate in different displays of other species (Chevalier-Skolnikoff, 1973; Preuschoft, 1995; Van Hooff, 1972).<sup>1</sup> This implies, according to certain evolutionary arguments, that laughter and smiling relate to different positive emotions, which has important implications for theories of emotion. A third motive of the present study, therefore, was to compare the experiential and social processes associated with laughter and smiling, which has yet to be done empirically.

## Origins and Forms of Human Laughter

Human laughter is believed to have evolved from the relaxed, open-mouth play face observed in other primates, such as chimpanzees and Barbary macaques (Darwin, 1872; Goodall, 1968; Van Hooff, 1972). The play face involves a widely opened mouth and quick, vocalized, staccato breathing that sounds like

Dacher Keltner, Department of Psychology, University of California, Berkeley; George A. Bonanno, Department of Psychology, Catholic University of America.

This research was supported in part by the Behavioral Science Track Award for Rapid Transition program of NIMH (Grant 144-FE-81).

Correspondence concerning this article should be addressed to Dacher Keltner, Department of Psychology, 3210 Tolman Hall, University of California, Berkeley, California 94720. Electronic mail may be sent via the Internet to keltner@socrates.berkeley.edu

<sup>1</sup> Certain scholars have called into question whether the silent, bared teeth display is the predecessor of the smile, suggesting that it actually involves the risorius muscle action involved in the lower facial expression of fear (Redican, 1982).

“ahh ahh ahh.” The relaxed open-mouth display occurs during forms of social play, such as mock fighting, and communicates that the behavior is playful and not dangerous (Bateson, 1969; Van Hooff, 1972).

Human laughter appears to share the form and function of the play face of other species (Darwin, 1872; Van Hooff, 1972; Yerkes, 1943). Laughter first appears at 1 to 2 months of age (Sroufe & Wunsch, 1972) and in childhood is associated with situations that begin with elevated levels of arousal that are eventually deemed safe or inconsequential, such as tickling, play, or the sudden appearance of novel stimuli (Rothbart, 1973). Studies of adults have focused on describing the experiential and physiological correlates of laughter associated with amusement and exhilaration. Exhilarated laughter involves open-mouth smiling as well as other facial muscle actions (Apte, 1985; Darwin, 1872; Sumitsuji, 1967), vocalization (typically a “he he” sound that evolves into a “ha ha” sound), postural relaxation with shoulder and torso shaking, and elevated heart rate and increased levels of expiration (see Ruch, 1993).

### Intrapersonal Processes Related to Human Laughter

Theoretical explanations of laughter have focused on the intrapersonal and interpersonal processes that explain its origins and apparent psychological benefits (for a review, see Weisfeld, 1993). In terms of intrapersonal processes, it is widely believed that laughter accompanies the dissociation of the experience of distress. Dissociative phenomena can be placed along a continuum that ranges from relatively normative shifts in psychological states, such as daydreaming and distraction (Singer, 1966) or discrepancies between direct and indirect measures of perceptual responses (Merikle & Reingold, 1992), to more severe or pathological alterations in memory and identity (Hilgard, 1986; James, 1890; Putnam, 1989). Laughter, as theory and evidence indicate, is a transient, mild form of dissociation from distress that promises joy and perhaps peace in response to stressful events.

Emotion theorists have focused on how laughter accompanies the shift from negative to positive emotion, consistent with the proposition that positive emotions are “undoers” of negative emotions (Levenson, 1988). Most notably, Tomkins (1984) proposed that the “smile of triumph,” or laughter, follows the reduction of anger, whereas the smile of joy follows the reduction of fear and distress. Cognitive analyses of humor have also linked laughter to the distancing from distressing events (Krokoff, 1991; Martin & Lefcourt, 1983). According to this view, laughter occurs when an individual adopts a novel perspective on, or gains insight into, a distressing event, incongruity, or violated expectation, which resolves the associated tension and brings about a shift to the positive state of humor (Martin & Lefcourt, 1983; McGhee, 1979; Ruch, 1993).

These theoretical observations, deriving from different traditions, ascribe certain characteristics to laughter. First, laughter involves a shift in psychological state, from negative to positive emotion or from incongruity and violated expectations to understanding and insight. Second, laughter involves a reduction in the distress associated with negative emotion, perceptual incongruity, or violated expectations. Third, the reduction in distress produces a positive feeling state that is labeled humor, amuse-

ment, mirth, or exhilaration. Taken together, these observations can be phrased as a laughter-as-dissociation hypothesis: Laughter accompanies the dissociation from potentially distressing arousal brought about by a positive reinterpretation of the source of distress.

Evidence in support of the laughter-as-dissociation hypothesis is indirect. Postulations about the conditions that give rise to laughter suggest that laughter occurs when potential danger is reinterpreted as safe and playful (Hayworth, 1928; Rothbart, 1973). Studies of individual differences in humor proneness consistently find that people predisposed to humor do indeed dissociate from distress. Comedians, when compared with non-comedians, were more likely to mention comic themes when making up stories about tragic pictures, translating the tragic into the pleasurable (Salamah, 1983). People who scored high on self-report measures of humor proneness reported increased positive affect in response to negative life events, whereas low-humor individuals reported reductions in positive affect (Kuiper, Martin, & Dance, 1992). Additional studies that we review below have found that people who frequently experience humor respond more positively to distress. Whereas these previous studies demonstrate a relation between dispositional humor and dissociation, in the present study we examined whether discrete episodes of laughter relate to a behavioral measure of the dissociation from distress.

### Interpersonal Functions of Human Laughter

Laughter has been found to occur in social contexts over 95% of the time (Provine & Fischer, 1989). In addition to regulating conversation (Provine, 1993), laughter enhances social relations by producing pleasure in others through simple contagious processes (Hatfield, Cacioppo, & Rapson, 1992; Provine, 1992) and by rewarding others' actions, thus encouraging ongoing social activities (Weisfeld, 1993). Studies of the role of laughter in social interaction and individual functioning demonstrate its prosocial benefits. For example, laughter increases the cohesiveness of groups (Vinton, 1989) and the success with which romantic couples solve personal conflicts (Keltner & Monarch, 1996). Individuals who frequently experience or cope with humor report more intimate social relations (Hampes, 1994), greater role satisfaction (Kuiper et al., 1992), and in the case of men, reduced loneliness (Overholser, 1992). Across interpersonal contexts, highly agreeable people, who tend to have more satisfying relationships, laugh more (Keltner, Bonanno, Caspi, Krueger, & Stouthamer-Loeber, 1996). Few studies, however, have focused on the immediate and direct effects of laughter on the emotions and inferences of others. In the present study, we examined whether laughter relates to enhanced social relations and more positive emotional responses and inferences in observers.

### Laughter and Coping With Distress

The presumed intrapersonal and interpersonal benefits of laughter are widely believed to contribute to improved psychological functioning during periods of stress (e.g., Coser, 1959; Dixon, 1980; Martin, 1989; Martin & Lefcourt, 1983). Three kinds of evidence support this claim. First, studies of romantic

couples have found with some consistency that laughter enhances relationship satisfaction. The self-reported tendency to laugh was correlated with reduced job distress in certain marriages (Krokoff, 1991). Couples who laughed while discussing a mutual conflict experienced less distress during the discussion and increased relationship satisfaction (Keltner & Monarch, 1996). Husbands' self-reported humor appreciation and ability to generate humor, as reflected in the captions they gave to cartoon drawings, were related to their self-reported marital satisfaction (Ziv & Gadish, 1989). The self-reported tendency to play, which produces elevated laughter, related to increased relationship satisfaction in romantic couples (Baxter, 1992).

Second, cross-sectional studies have found that laughter and humor reduce the negative effects of stress upon well-being. For example, listening to a comedian following a negative affect induction (the Velten procedure) raised participants' heart rate, increased smiling, and lowered scores of depression relative to a control group (Danzer, Dale, & Klions, 1990). People who frequently experience humor reported less mood disturbance to stressful life events than less humor-prone individuals (Martin & Lefcourt, 1983).

Third, prospective studies have found that humor predicts improved psychological functioning during distress (e.g., Nezu, Nezu, & Blissett, 1988). The tendency to use humor as a coping mechanism predicted less distress in women 6 months after breast cancer surgery and mediated the relationship between global optimism and reduced postsurgery distress (Carver et al., 1993). People who reported little inclination to cope with humor responded with increased depression to negative life stresses, whereas people who reported using humor as a coping mechanism were not negatively affected by life stresses (Martin & Lefcourt, 1983) and in one study reported increased positive emotion in response to stressful events (Kuiper et al., 1992). In sum, these studies confirm the hypothesized association between laughter, as assessed with self-report measures of humor proneness, and the dissociation from the negative impact of distressing events.

### Laughter During Bereavement

The preceding analysis suggests that laughter should relate to improved functioning in response to losing a spouse. At first glance, this proposal is at odds with traditional bereavement theories, which have emphasized the importance of working through the emotional pain of the loss (Freud, 1917/1957; Lazare, 1989; Lindemann, 1944; Raphael, 1983) and have generally viewed the expression of positive emotion as an indication of denial and as an impediment to grief resolution (Deutsch, 1937; Sanders, 1993). Numerous theorists, however, have recently identified limitations of the "grief work" view (Bonanno, *in press*; M. S. Stroebe & Stroebe, 1991; Wortman & Silver, 1989) and have begun to consider the adaptive functions of positive emotions during bereavement (Shuchter & Zisook, 1993), which are well documented in the literature of mourning processes across cultures (Bonanno, *in press*).

In a recent study, we provided causal evidence for the benefits of laughter during bereavement (Bonanno & Keltner, 1997). Facial expressions of emotion were coded from videotapes of 40 bereaved adults as they described their prior relationship

with their deceased spouse 6 months after the loss and were related to valid and reliable measures of participants' grief severity gathered at 6, 14, and 25 months postloss. Consistent with established links between humor and positive responses to stressful events (e.g., Martin & Lefcourt, 1983), laughter that involved the action of the orbicularis oculi muscle, known as Duchenne laughter, as explained below, predicted reduced grief severity at each outcome assessment. Further, these correlations remained significant when the overlapping variance associated with self-reported emotion was partialled out.

### Emotional Dissociation During Bereavement

Our initial study documented that Duchenne laughter predicted improved long-term functioning during bereavement. In the present study we followed up on the same participants from this initial study to determine specifically how laughter may lead to improved functioning through the dissociation of stress and enhanced social relations. An initial consideration was the measurement of concomitant laughter and the dissociation of distress. Self-report measures of dissociative processes are typically retrospective and assess dissociative tendencies at the trait level (e.g., Bernstein-Carlson & Putnam, 1986). At the actual time of their occurrence, behavioral manifestations of dissociation are by definition unlikely to be accessible to direct, introspective self-report (James, 1890; Wegner & Pennebaker, 1993).

Previous research on emotion, stress, and coping has addressed this problem by using a behavioral index of dissociation based on the discrepancy between measures of verbal and autonomic responses during stressful situations (for review, see Bonanno, Keltner, Holen, & Horowitz, 1995). This approach, similar to the dissociation paradigm used in the study of unconscious perception (Erdelyi, 1985; Merikle & Reingold, 1992), allows for the comparison of concomitant laughter and dissociation. The conceptual logic of this measure is straightforward. The appraisal of emotional stressors elicits multiple responses, including cardiovascular activity and verbal and conceptual processes related to the regulation of subjective emotion (Fowles, 1980; Lazarus, 1991; Leventhal, 1991; Mayer & Gaschke, 1988; Newton & Contrada, 1992). Dissociations between indicators of emotional response are not uncommon; emotions may be experienced subjectively in the absence of physiological or expressive response, or physiological changes may be dissociated or not fully experienced (e.g., Lang, Levin, Miller, & Kozak, 1983; Schwartz, Fair, Salt, Mendel, & Klerman, 1976). When relatively little negative emotion is reported despite indication of threat-reactivity in other response domains, emotion-focused avoidant coping processes, such as emotional dissociation, are assumed to be operative (Krohne, 1992; Lazarus, 1966; Leventhal, 1984; Newton & Contrada, 1992). The verbal-autonomic dissociation pattern of elevated cardiovascular response relative to reduced self-reports of negative emotion, therefore, reflects an initial appraisal of the threat, increased cardiovascular response, and a dissociative shift in awareness and reduction in subjective distress (Bonanno, 1995; Bonanno et al., 1995; Leventhal, 1991; Temoshok, 1987; Weinberger & Davidson, 1994).

The validity of verbal-autonomic response dissociation as an indicator of reduced awareness of distress is supported by numerous studies. The verbal-autonomic dissociation measure

relates to repressive coping (Asendorpf & Scherer, 1983; Newton & Contrada, 1992; Weinberger, Schwartz, & Davidson, 1979), the avoidance of negative content while talking about stressful events (Weinberger et al., 1979; Weinberger & Davidson, 1994), and clinical ratings of the avoidance of emotional awareness (Bonanno et al., 1995). Additionally, our longitudinal bereavement project demonstrated that verbal-autonomic dissociation, like measures of laughter, predicted reduced grief (Bonanno et al., 1995). The present study asked the next logical question: Will laughter relate to verbal-autonomic dissociation, as preceding accounts of laughter suggest?

### The Current Investigation

Theories of humor and positive emotion led us to predict that laughter would relate to the dissociation of distressing emotion associated with the death of a spouse and to enhanced social relations. We tested these two hypotheses by examining the relations between bereaved adults' laughter and smiling observed during a bereavement interview and (a) their self-reports of negative and positive emotion, (b) their scores on a validated measure of verbal-autonomic response dissociation, (c) their self-reports of their relations with the deceased spouse and current others, and, using methods from studies of the evocative properties of smiles (Frank et al., 1993; Keltner, 1995), (d) the responses and inferences evoked in observers.

The present study advances the methods of previous studies of laughter and humor in significant ways. First, we examined actual laughter rather than self-reported laughter or humor. Second, we used a well-validated behavioral measure of the dissociation of distress. Third, we examined the hypothesized functions of laughter during a time of acute stress, the recent death of a spouse, thus providing strong tests of the hypothesized intrapersonal and interpersonal functions of laughter. Finally, the present study was the first to examine the emotions and social inferences laughter evokes in others, which is germane to the study of emotional contagion (Hatfield et al., 1992) and how distressed individuals influence those who might provide comfort as would-be listeners (Bonanno & Keltner, 1997; Coyne, 1976; Harber & Pennebaker, 1992). It is interesting to note that grieved individuals often report inadequate support in their social environment (Lehman, Ellard, & Wortman, 1986; Nuss & Zubenko, 1992). The assessment of the influence of laughter or its absence on potential support providers may provide clues to how bereaved individuals evoke social support in others.

Previous research on smiles suggests that the predicted relationships between laughter, the dissociation of distress, and enhanced social relations will hold only for certain kinds of laughter. Specifically, research has distinguished between non-Duchenne smiles, which involve the zygomatic major muscle action that pulls the lip corners up obliquely, and Duchenne smiles, which also involve orbicularis oculi muscle action, which orbits the eye, pulling the skin from the cheeks and forehead toward the eyeball (Duchenne de Bologne, 1862; Ekman & Friesen, 1982; Frank et al., 1993; Keltner & Ekman, 1994).<sup>2</sup> Only Duchenne smiles are associated with pleasant stimuli and feelings (Ekman, Friesen, & O'Sullivan, 1988), children's response to familiar adults (Fox & Davidson, 1988), and reduced grief severity (Bonanno & Keltner, 1997). In addition, Duchenne

smiles are judged by observers as more interpersonally positive than non-Duchenne smiles (Frank et al., 1993). These findings led us to predict that Duchenne laughter would be associated with the intrapersonal and interpersonal benefits that we have attributed to laughter, whereas non-Duchenne laughter would not.

On the basis of the proposition that laughter relates to the dissociation from distress, we expected Duchenne laughter to be associated with (a) self-reports of reduced negative emotion and increased positive emotion and (b) reduced negative emotion relative to cardiovascular responsivity, i.e., verbal-autonomic response dissociation. On the basis of the hypothesized link between laughter and enhanced social relations, we expected Duchenne laughter to relate to (a) more positive evaluations of the prior relationship with the deceased spouse, (b) reduced ambivalence toward a current important other, and (c) more positive responses evoked in observers. We predicted that non-Duchenne laughter, in contrast, would not relate to the measures of emotional response and social relations in these six ways.

A final aim was to determine whether laughter and smiling relate to different intrapersonal and interpersonal processes. Ethologists have claimed that the open-mouth play face of non-human primates relates to activities, most commonly play, that differ from those associated with the silent bared-teeth display thought to be the origin of human smiling (Hinde, 1974; Van Hooff, 1972). Laughter and smiling, by implication, may be the signals of different positive emotions. This claim has important implications for theories of emotion but little related evidence and motivated certain analyses.

### Method

#### Participants

Conjugal bereaved participants were recruited by newspaper advertisements, posted notices, and referrals from a variety of institutions within the San Francisco Bay area (e.g., medical centers, religious organizations). These sources requested volunteers between the ages of 21 and 55 who had sustained the death of a spouse between 3 and 6 months earlier and who had previously been either married to or living with their partner for at least 3 years. Participants were paid \$10.00 per hour. Eighty-eight participants were recruited for a longitudinal bereavement study (Horowitz et al., 1996). From this sample, 40 participants were selected randomly for the present study (see also Bonanno et al., 1995; Bonanno & Keltner, 1997). A multivariate analysis of variance (MANOVA) revealed no differences on several sociodemographic variables between participants in the present study's sample ( $n = 40$ ) and those from the larger bereavement sample ( $n = 48$ ) who were not included in the analyses conducted in the present study ( $p > .20$ ). One of the 40 participants who was selected for the present study did not have complete data, which resulted in a final sample size of 39. Participants in this sample of 39, on average, were 48.9 years old, had achieved 12.4

<sup>2</sup> There are other behavioral markers that differentiate Duchenne from non-Duchenne smiles, including the duration of the smile and its smoothness of onset and offset (Frank et al., 1993). In the present study, we differentiated between Duchenne and non-Duchenne laughter and smiles on the basis of the presence of the orbicularis oculi muscle action and hereafter use *Duchenne* as a shorthand designation of the different kinds of laughter and smiling based on this distinction.

years of education, were predominantly female (67%) and Caucasian (73%, compared with 12% Asian, 8% African American, 3% Hispanic, and 4% other).

### Procedure

Participants were mailed and then completed self-report questionnaires. Next, they participated in a structured grief symptom interview, conducted approximately 6 months ( $M = 5$  months, 18 days) after the death of the spouse, which was followed by a semistructured bereavement interview pertaining specifically to the qualities of the lost relationship, conducted on the average 17 days later. Data from the structured grief symptom interview are reported elsewhere (Bonanno et al., 1995; Bonanno & Keltner, 1997).

**Questionnaire measures.** Participants filled out two questionnaire measures that related to our predictions concerning laughter and enhanced social relationships: Perceived relationship adjustment was measured using retrospective assessments of the conjugal relationship on the Dyadic Adjustment Scale (DAS; Spanier, 1976); ambivalence toward the most important person in the participant's life other than the deceased spouse or the participant's parents was measured using the Semantic Representations of Others Scale (SROS; Bonanno, Gunzerath, Notariou, Keltner, & Horowitz, 1996) which assesses the strength of both positive and negative feelings toward the target individual. Given our interest in how brief episodes of Duchenne laughter relate to emotions and the quality of social relations, it was important to attempt to control for dispositional tendencies and social factors that might account for variation in intrapersonal (e.g., emotional responses) and interpersonal outcomes during bereavement. Because extraversion, agreeableness, and neuroticism predict the stable disposition to experience positive and negative emotions and social outcomes (e.g., Costa & McCrae, 1980; Keltner, 1996; Watson & Clark, 1992), we gathered participants' self-assessments of their personality measured in terms of the dimensions of the five-factor model (Neuroticism, Extraversion, Agreeableness, Conscientiousness, and Openness to Experience) using the NEO Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1992). Perceived interpersonal coping resources may also relate to participants' inclination to experience certain emotions and develop certain relations during bereavement (W. Stroebe & Stroebe, 1987). We therefore gathered two measures related to perceived interpersonal coping resources: Perceived social support was measured by adapting items from several domains reported by Kessler and colleagues (Kessler, Kendler, Heath, Neale, & Eaves, 1992); social networks was measured by adapting items reported by Kessler et al. (1992) and was scored as the sum of self-reported frequency of interactions with friends, relatives, and affiliative organizations. Demographic information was also obtained from a brief standardized questionnaire.

**Narrative bereavement interview.** The bereavement interview was conducted in a  $2.4 \times 3$  m room. Participants were seated in a comfortable chair facing a similar unoccupied chair and two wall-mounted cameras and were informed that the interview would be videotaped and that their physiological responses would be recorded. After physiological sensors were attached, participants were instructed to sit quietly and to relax "for a few minutes." After participants completed a 10-min baseline, the interviewer entered the room and read a scripted introduction to the interview. Participants were informed that they would be asked to speak about specified persons in their life for 18 min. Participants were also informed that the interviewer would always keep track of the time, that the best way to approach the task was to "try to relate as openly as possible whatever comes to your mind," and that the interviewer would seldom speak other than to ask clarifying questions. To encourage spontaneous discourse, it was stated that "if at any time you go blank or run out of things to say, just relax and give yourself time to think about something else related to the topic." The specified topic persons were

(a) the deceased and (b) the most important person currently in the participant's life, who were discussed in one of two random orders. Each of the two interview topics lasted 18 min and involved the interviewer asking participants to describe their relationship with the specified person. The interviewer first asked participants to describe their relationship with the specified person and, after approximately 6 min, requested specific memories involving the participant and the topic person. On the basis of an initial viewing of the videotaped interviews, in which we found that the initial 6-min portion of the interview that focused on the deceased spouse elicited the most emotion, we decided to code the behavior from only that portion of the interview.

**Self-reports of emotion.** At the completion of each topic of the bereavement interview, participants were asked to rate how often during the discussion just completed they had experienced each of two positive emotions (interest and enjoyment), four negative emotions (fear, guilt, anger, and distress), and surprise. Responses were made on a 4-point scale (0 = *not at all*, 3 = *almost constantly*). To encourage honesty in responding, participants were informed that the interviewer would not view their responses.

**Heart rate change.** Heart rate was measured by electrocardiogram from a wrist and forearm sensor placement. Electrocardiograms were processed in real time by an r-wave detector (Vitalog Corporation), which generated a pulse signal at the occurrence of each waveform. The timing of this signal can be accurately assessed by sampling at 800–1,000 Hz. Heart rate data were derived from the weighted average of R-R intervals (Veldern & Graham, 1988) yielding a second-by-second time series. Average beats per minute (BPM) were then calculated. For the present study, we computed heart rate change by subtracting each participant's average baseline heart rate from their average heart rate during the deceased topic. For the bereavement topic, the mean increase in BPM from baseline was 4.59 ( $SD = 5.85$ ), with 33 of the 39 participants in the present study showing an increase in BPM. Bonanno et al. (1995) reported that the total number of words used by each participant was not significantly correlated with heart rate change in the deceased topic ( $r = .17$ ,  $p > .20$ ), indicating that verbal output did not meaningfully influence heart rate. Nor was heart rate change related to self-reports of positive emotion ( $r = .01$ ,  $ns$ ) or negative emotion ( $r = -.01$ ,  $ns$ ).

**Verbal-autonomic response dissociation.** On the basis of previous studies, Bonanno et al. (1995) adhered to two criteria to derive verbal-autonomic dissociation scores. In keeping with the first criterion, participants' self-rated negative emotion and heart rate change related to the deceased topic interview were not significantly correlated ( $r = -.01$ ,  $ns$ ). In keeping with the second criterion, self-rated negative emotion and heart rate change showed opposite predictive relationships with grief severity. Accordingly, we calculated verbal-autonomic response discrepancy by (a) converting self-rated negative emotion and heart rate change to  $z$  scores based on the sample mean and (b) subtracting each participant's standardized heart rate score from his or her standardized self-rated negative emotion score (Asendorpf & Scherer, 1983; Newton & Contrada, 1992). Verbal-autonomic dissociation is indicated by a negative discrepancy score (self-rated negative emotion < heart rate), and verbal-autonomic sensitization is indicated by a positive discrepancy score (self-rated negative emotion > heart rate). In the present study, the verbal-autonomic discrepancy score ranged from  $-3.82$  to  $2.74$  ( $M = -0.09$ ;  $SD = 1.54$ ).

**Coding of facial behavior.** The participants' facial behavior observed during the initial part of the deceased topic interview (about 6 min on average) was coded using the EMFACS version of the Facial Action Coding System (FACS; Ekman & Friesen, 1976, 1978). EMFACS concentrates on coding only the emotion-relevant facial muscle movements that have been derived from previous theory and research (reviewed in Ekman, 1984). EMFACS criteria were used to code facial expressions of anger, contempt, disgust, fear, sadness, and surprise as

well as Duchenne and non-Duchenne smiles. Duchenne and non-Duchenne laughter were coded when Duchenne and non-Duchenne smiles were accompanied by audible laughter-related vocalization and an open mouth (Keltner, 1995; Ruch, 1993; Van Hooff, 1972). Each facial muscle movement was scored on a 5-point scale (1 = *minimal intensity*, 3 = *moderate intensity*, 5 = *extreme intensity*).

**Reliability of facial coding.** The person who coded the behavior of all participants (D.K.) was blind to participants' levels of grief, self-reports of emotions, verbal-autonomic dissociation, and personality. A second person (C.M.), who had passed a FACS reliability test and was blind to the investigation's aims and participants' scores on the different measures, coded five randomly selected participants. Following previous studies (e.g., Ekman, Friesen, & Ancoli, 1980; Keltner, 1995), we evaluated intercoder reliability by using a ratio in which the number of action units on which the two coders agreed was multiplied by 2 and then divided by the total number of action units scored by the two persons. This agreement ratio was calculated for each event observed by one or both coders. The mean ratio of agreement was .80.

**Observers' emotions and inferences.** To assess the emotions and inferences the bereaved individuals' expressive behavior evoked in others who might serve as would-be listeners (Harber & Pennebaker, 1992), we presented the videotaped records of the bereaved individuals to groups of six to eight college students on a 27-inch monitor in a classroom. Eight videotapes were created, with five different bereavement participants presented randomly on each tape. The videotapes presented the 6-min portion of the bereavement interview of each participant, whose upper torso and face were clearly visible. The videotaped segments were presented without sound so that we could examine the influence of bereaved individuals' expressive behavior on the emotions and inferences of observers independent of the content of the bereaved individuals' speech, which was often moving and poignant. Altogether, 40 bereaved participants were presented to observers: Each group of observers viewed five bereaved participants, and each bereaved participant was judged by six to eight observers. Observers were told that the study was investigating people's judgments and reactions to people under stress and that they would view five different people who were talking about the recent death of their spouse. They were instructed that they would not hear sound and that they were to offer their honest impressions about how the person was doing and how they felt toward the individual. Observers were asked to not respond audibly to the participants so as to avoid influencing other observers' judgments. Because bereaved individuals often report that potential support providers misconstrue their distress and what is helpful or needed (Lehman et al., 1986; Maddison & Walker, 1967), several items were designed to capture observers' overall assessment of the bereaved target's level of adjustment. Observers rated the degree that the person in the video (a) was "well adjusted," (b) "seemed to be suffering from severe grief," and (c) "seemed to be coping well." Because bereaved individuals have reported inadequate social support (Nuss & Zubenko, 1992), several items were designed to capture observers' inclinations to help the bereaved participant: (a) "I would help this person in whatever way possible" and (b) "I would willingly offer comforting advice or a pat on the back to this person." Similarly, several items were designed to capture observers' inclinations to avoid the bereaved: (a) "I would avoid prolonged contact with this person," (b) "If possible, I would avoid speaking with this person," (c) "I would try to minimize spending time with this person," (d) "I would quickly grow tired of speaking with this person," and (e) "I could tolerate only brief conversations with this person." Each of these ratings was made on a 7-point scale (1 = *not at all*, 7 = *definitely*). Observers also rated how much amusement, compassion, frustration, happiness, pity, sadness, and sympathy they felt toward each bereaved participant (0 = *no emotion*, 8 = *a great deal of emotion*).

## Results

We pursued two strategies to test the hypotheses that laughter relates to the dissociation from distress and enhanced social

relations. First, on the basis of similar studies relating expressive behavior to subjective and physiological responses (e.g., see Gross, Fredrickson, & Levenson, 1994, for study of crying), we compared on the relevant dependent measures those individuals who displayed at least one instance of Duchenne laughter during the 6-min bereavement interview (Duchenne laughers) with those individuals who did not display Duchenne laughter (nonlaughers). Of the 21 Duchenne laughers, 4 also displayed non-Duchenne laughter. Of the 18 nonlaughers, 2 displayed non-Duchenne laughter.<sup>3</sup> These between-group comparisons, however, did not allow us to examine the relations between the amount of laughter and smiling shown and the dependent measures, nor did these comparisons allow us to assess the anticipated differences between Duchenne laughter and non-Duchenne laughter and Duchenne smiling. Our second strategy, therefore, was to examine the correlations across all participants between the measures of Duchenne and non-Duchenne laughter and smiling and the relevant dependent measures so that we could determine whether Duchenne laughter relates to the dissociation of distress and social relations in different ways than non-Duchenne laughter and Duchenne smiling. The measures of Duchenne and non-Duchenne laughter and smiling were equal to the sum of the standardized measures of the frequency, intensity, and duration of each kind of expression (see Bonanno & Keltner, 1997).

## Comparison of Duchenne Laughers and Nonlaughers

It first was important to establish whether Duchenne laughers and nonlaughers differed in their self-rated personality, social support, and the nature of their spouses' death, which, as we reasoned previously, might account for variance in the measures of emotional experience and social relations. Table 1 presents the relevant means and two sample *t* tests comparing laughers and nonlaughers on these measures. A MANOVA revealed that Duchenne laughers and nonlaughers did not differ in their pattern of self-reported personality,  $F(5, 32) = 1.10$ , *ns*, nor did the participants in the two groups differ in their levels of each of the five traits of the five-factor model of personality, which consistently predict emotion and social relationships (Keltner, 1996). Duchenne laughers did not differ from nonlaughers in their self-rated social support and social networks, the frequency with which they reported having a confidant with whom they could discuss the death (75% versus 78%,  $z = -0.20$  *ns*), nor

<sup>3</sup> We considered several options for classifying participants as laughers or nonlaughers, including (a) comparing participants who showed any laughter, Duchenne or non-Duchenne, with those who did not; (b) comparing participants who showed only Duchenne laughter with those who showed no laughter; and the chosen option, (c) comparing participants who showed Duchenne laughter with those who did not show Duchenne laughter. We elected to classify our participants according to this last approach on the basis of our conceptual analysis presented at the end of the introduction, which stated that only Duchenne laughter would relate to the benefits attributed to laughter. Of note, the group comparisons based on Procedure b above, which eliminated the two participants who showed non-Duchenne laughter from the nonlaughter group, yielded the same pattern of statistically significant results as the approach we followed in the results section.

Table 1  
*Comparisons of Laughters and Nonlaughters on Demographic,  
 Personality, and Coping Measures*

Measure	Duchenne laughers ( <i>n</i> = 21)	Nonlaughters ( <i>n</i> = 18)	<i>t</i> (37)	<i>p</i>
Age				
<i>M</i>	48.38	49.56	0.27	<i>ns</i>
<i>SD</i>	6.66	5.27		
Neuroticism				
<i>M</i>	18.41	20.53	0.89	<i>ns</i>
<i>SD</i>	7.33	6.40		
Extraversion				
<i>M</i>	30.12	26.65	1.60	<.15
<i>SD</i>	5.62	6.96		
Openness to experience				
<i>M</i>	31.18	30.77	0.20	<i>ns</i>
<i>SD</i>	3.49	7.44		
Agreeableness				
<i>M</i>	33.35	33.82	0.22	<i>ns</i>
<i>SD</i>	7.39	4.92		
Conscientiousness				
<i>M</i>	32.24	30.65	0.97	<i>ns</i>
<i>SD</i>	4.27	5.23		
Social support				
<i>M</i>	1.55	1.52	0.14	<i>ns</i>
<i>SD</i>	0.52	0.57		
Social networks				
<i>M</i>	2.26	2.37	0.51	<i>ns</i>
<i>SD</i>	0.66	0.76		
Income change				
<i>M</i>	2.00	2.01	0.01	<i>ns</i>
<i>SD</i>	1.29	1.86		
Forewarning of death (in days)				
<i>M</i>	190.57	173.94	0.17	<i>ns</i>
<i>SD</i>	330.90	248.85		

*Note.* Income change refers to the proportion by which the participant's income changed following the death of the spouse.

on variables related to the nature of their spouse's death (e.g., the death-related income change, the forewarning of the spouses' death). Given that other emotions that Duchenne laughers and nonlaughters may have expressed during the 6-min interview could have influenced their self-reports of emotions and responses evoked in observers, we conducted two sample *t* tests comparing Duchenne laughers' and nonlaughters' facial expressions of anger, contempt, disgust, fear, and sadness (the measure of each emotion was equal to the sum of the standardized frequency, intensity, and duration scores). All of these comparisons were nonsignificant (all *ps* > .15). Finally, Duchenne laughers were no more likely to be women (71%) than nonlaughters (61%), *z* = 0.68, *ns*.

#### *Laughter and Self-Reports of Negative and Positive Emotion*

The laughter-as-dissociation hypothesis led us to predict that Duchenne laughter would relate to self-reports of reduced negative emotion and increased positive emotion. The relevant comparisons between Duchenne laughers and nonlaughters are presented in Table 2. The MANOVA revealed that Duchenne laughers and nonlaughters differed in their overall pattern of self-

reports of emotion on the six individual items,  $F(6, 32) = 3.09$ ,  $p < .05$ .<sup>4</sup> Consistent with the first prediction of the laughter-as-dissociation hypothesis, while talking about their deceased spouse, Duchenne laughers compared with nonlaughters reported less anger (*Ms* = 0.19 vs. 0.94),  $t(37) = -3.55$ ,  $p < .001$ , distress (*Ms* = 1.19 vs. 1.83),  $t(37) = -2.61$ ,  $p = .01$ , and overall negative emotion, which was equal to the average of the ratings of anger, distress, fear, and guilt (*Ms* = 0.51 vs. 1.00),  $t(37) = -3.49$ ,  $p < .01$ . Consistent with the second prediction of the laughter-as-dissociation hypothesis, Duchenne laughers compared with nonlaughters reported greater positive relative to negative emotion (*Ms* = 1.49 vs. 0.67),  $t(37) = 2.66$ ,  $p < .01$ , and showed a marginal trend toward reporting greater enjoyment (*Ms* = 1.71 vs. 1.17),  $t(37) = 1.66$ ,  $p < .10$ .

The correlations presented in Table 3 address the hypothesis that the degree of Duchenne laughter would relate to self-reports of emotion in the predicted fashion, whereas non-Duchenne laughter would not. As predicted, Duchenne laughter was negatively correlated with self-reports of anger ( $r = -.49$ ,  $p < .01$ ),

<sup>4</sup> All MANOVAs reported in the results section used the individual dependent measures but not the created composite measures in the analyses.



Table 2  
*Self-Reports of Emotion of Laughters and Nonlaughters*

Measure	Duchenne laughers ( <i>n</i> = 21)	Nonlaughters ( <i>n</i> = 18)	<i>t</i> (37)	<i>p</i>
Anger				
<i>M</i>	0.19	0.94	3.55	<.001
<i>SD</i>	0.40	0.87		
Distress				
<i>M</i>	1.19	1.83	2.61	.01
<i>SD</i>	0.68	0.86		
Fear				
<i>M</i>	0.19	0.50	1.58	<i>ns</i>
<i>SD</i>	0.51	0.71		
Guilt				
<i>M</i>	0.48	0.72	1.14	<i>ns</i>
<i>SD</i>	0.60	0.75		
Overall negative emotion				
<i>M</i>	0.51	1.00	3.49	<.001
<i>SD</i>	0.29	0.57		
Interest				
<i>M</i>	2.29	2.17	0.27	<i>ns</i>
<i>SD</i>	0.64	0.79		
Enjoyment				
<i>M</i>	1.71	1.17	1.66	<.10
<i>SD</i>	1.01	1.04		
Overall positive emotion				
<i>M</i>	2.00	1.67	1.41	<i>ns</i>
<i>SD</i>	0.65	0.82		
Positive – negative				
<i>M</i>	1.49	0.67	2.66	.01
<i>SD</i>	0.78	1.14		

*Note.* Overall negative emotion is equal to the mean of self-reports of anger, distress, fear, and guilt. Overall positive emotion is equal to the mean of self-reports of enjoyment and interest.

distress ( $r = -.36, p < .05$ ), and overall negative emotion ( $r = -.47, p < .01$ ), whereas non-Duchenne laughter was not significantly correlated with these measures ( $r_s = .18, .17, .16$ , respectively, *ns*). Also as predicted, Duchenne laughter was correlated with self-reports of increased enjoyment ( $r = .34, p < .05$ ) and overall positive emotion ( $r = .31, p < .05$ ), as well as the positive–negative emotion difference score ( $r_s = .45, p < .01$ ). The measure of non-Duchenne laughter, in contrast,

was not significantly correlated with self-reports of enjoyment ( $r = -.01, ns$ ), overall positive emotion ( $r = -.12, ns$ ), or the positive–negative emotion difference score ( $r = -.16, ns$ ). The measure of Duchenne smiling was negatively correlated with self-reports of distress ( $r = -.49, p < .01$ ), fear ( $r = -.31, p < .05$ ), anger ( $r = -.28, p < .10$ ), and overall negative emotion ( $r = -.43, p < .05$ ) and was positively correlated with self-reports of enjoyment ( $r = .35, p < .05$ ), overall positive

Table 3  
*Correlations Between Measures of Laughter, Smiling Behavior, and Self-Reports of Emotion*

Measure	Duchenne laughter	Non-Duchenne laughter	Duchenne smile	Non-Duchenne smile
Anger	-.49**	.18	-.28 <sup>†</sup>	.09
Distress	-.36*	.17	-.49**	-.16
Fear	-.24	-.02	-.31*	.04
Guilt	-.17	.07	-.06	.09
Overall negative emotion	-.47**	.16	-.43**	.02
Interest	.15	-.24	.17	.06
Enjoyment	.34*	-.01	.35*	-.25
Overall positive emotion	.31*	-.12	.33*	-.10
Positive – negative	.45**	-.16	.43**	-.06

*Note.* Overall negative emotion is equal to the mean of self-reports of anger, distress, fear, and guilt. Overall positive emotion is equal to the mean of self-reports of enjoyment and interest.

<sup>†</sup>  $p < .10$  (marginally significant). \*  $p < .05$ . \*\*  $p < .01$ .



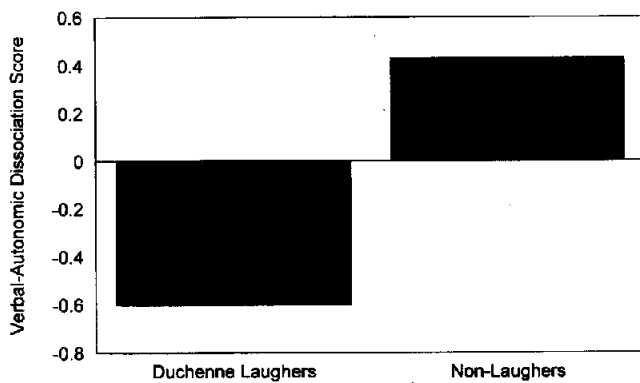


Figure 1. Verbal-autonomic discrepancy scores of laughers and non-laughers.

emotion ( $r = .33, p < .05$ ), and the positive-negative emotion difference score ( $r = .43, p < .01$ ). The measure of non-Duchenne smiles was not significantly correlated with any of the self-report measures of emotion.

#### Laughter and Dissociation of Distress

The third prediction of the laughter-as-dissociation hypothesis specified that Duchenne laughter would be associated with the reduced awareness of distress, as measured by the verbal-autonomic dissociation score. The comparison between Duchenne laughers and nonlaughers is presented in Figure 1. Duchenne laughers had discrepancy scores in the direction of verbal-autonomic dissociation ( $M = -0.60$ ), whereas nonlaughers showed the opposite discrepancy score, or verbal-autonomic sensitization ( $M = 0.43$ ),  $t(37) = 2.46, p < .05$ . Consistent with this group difference, the degree of Duchenne laughter was nega-

tively correlated with verbal-autonomic discrepancy, indicating that it was related to the dissociation of distress ( $r = -.37, p < .05$ ), whereas the degree of non-Duchenne laughter was positively correlated with the discrepancy score, indicating the sensitization of distress ( $r = .38, p < .05$ ). The degree of Duchenne smiling was marginally correlated with the verbal-autonomic discrepancy score in the direction of dissociation ( $r = -.29, p < .10$ ). Overall, 67% of the Duchenne laughers showed a verbal-autonomic dissociation score in the direction of dissociation, whereas only 39% of the nonlaughers showed the dissociative pattern,  $\chi^2(1, N = 39) = 3.01, p < .10$ .

#### Laughter and the Quality of Interpersonal Relations

To test our predictions related to the hypothesis that Duchenne laughter would relate to enhanced interpersonal relations, we examined the relations between participants' laughter and smiling and their retrospective evaluations of their relationships with their deceased spouse, the ambivalence they reported toward a current important other, and measures of the emotions and inferences they evoked in observers. The means of Duchenne laughers' and nonlaughers' remembered levels of adjustment in their relationship with their deceased spouse and their ambivalence toward a current important other are presented in Table 4. The correlations between the measures of social relations and laughter and smiling are presented in Table 5. The MANOVA revealed that Duchenne laughers and nonlaughers differed significantly in their reports across the four DAS subscales,  $F(4, 34) = 3.57, p < .05$ . More specific comparisons revealed that compared with nonlaughers, Duchenne laughers remembered relationships with their deceased spouse as characterized by higher overall adjustment ( $M_s = 114.19$  vs.  $102.06$ ),  $t(37) = 2.10, p < .05$ , consensus ( $M_s = 51.95$  vs.  $44.72$ ),  $t(37) = 2.84, p < .01$ , and cohesiveness ( $M_s = 17.81$  vs.  $15.11$ ),  $t(37) = 1.99, p < .05$ . The correlations yielded similar findings. Du-

Table 4  
Social Relationships of Laughers and Nonlaughers

Measure	Duchenne laughers ( <i>n</i> = 21)	Nonlaughers ( <i>n</i> = 18)	<i>t</i> (37)	<i>p</i>
DAS overall satisfaction				
<i>M</i>	114.19	102.06	2.10	<.05
<i>SD</i>	15.19	20.87		
DAS consensus				
<i>M</i>	51.95	44.72	2.84	<.01
<i>SD</i>	6.54	9.29		
DAS cohesiveness				
<i>M</i>	17.81	15.11	1.99	.05
<i>SD</i>	3.61	4.83		
DAS satisfaction				
<i>M</i>	35.67	33.83	1.02	<i>ns</i>
<i>SD</i>	5.11	6.14		
DAS affection				
<i>M</i>	8.76	8.39	0.44	<i>ns</i>
<i>SD</i>	2.53	7.27		
Ambivalence in current relation				
<i>M</i>	3.05	3.49	1.61	<.15
<i>SD</i>	0.75	0.68		

Note. DAS = Dyadic Adjustment Scale.

Table 5  
Correlations Between Measures of Laughter, Smiling Behavior, and Social Relationships

Measure	Duchenne laughter	Non-Duchenne laughter	Duchenne smile	Non-Duchenne smile
DAS overall satisfaction	.27 <sup>†</sup>	.10	.18	-.11
DAS consensus	.39*	.06	.19	-.03
DAS cohesiveness	.25	.06	.20	-.18
DAS satisfaction	.07	.15	.14	-.16
DAS affection	.10	.11	.00	-.10
Ambivalence in current relation	-.34*	.13	.01	.20

Note. DAS = Dyadic Adjustment Scale.

<sup>†</sup>  $p < .10$  (marginally significant). \*  $p < .05$ .

chenne laughter was significantly correlated with the remembered relationship consensus ( $r = .39, p < .01$ ) and marginally significantly correlated with overall relationship adjustment ( $r = .27, p < .10$ ). In contrast, the measures of non-Duchenne laughter and Duchenne and non-Duchenne smiles were not significantly correlated with the composite measures of relationship adjustment or the four DAS subscales (all  $ps > .10$ ).

On the basis of the notion that Duchenne laughter would facilitate positive relations during bereavement, we expected Duchenne laughter to relate to less ambivalence toward a current important other. Consistent with this hypothesis, Table 5 shows that the degree of Duchenne laughter was correlated with the measure of reduced ambivalence toward a current important other ( $r = -.34, p < .05$ ), whereas the measures of non-Duchenne laughter ( $r = .13, ns$ ), Duchenne smiles ( $r = .01, ns$ ), and non-Duchenne smiles ( $r = .20, ns$ ) were not.

#### Laughter and Evoked Responses in Observers

Because the previously discussed measures of social relations were retrospective in nature, we gathered observers' judgments of and emotional responses to the bereaved participants so that we could more directly assess how laughter influences others. Toward this aim, we first calculated the means of each group of observers' ratings of the bereaved participants on the different items. On the basis of our conceptual rationale (discussed in the Methods section) and high interitem correlations, we created composite measures of observers' judgments of (a) the bereaved

participant's overall adjustment (the average of the ratings of the bereaved participant's adjustment and coping effectiveness,  $r = .90, p < .0001$ ); (b) how much comfort they would be inclined to offer (the average of observers' indicated inclination to offer help and pat the person on the back,  $r = .60, p < .001$ ); (c) how much they felt inclined to avoid contact with the bereaved participant (the average of the five avoidance items, average  $r = .71, p < .001$ ); and (d) how much compassion they indicated feeling for the bereaved (the average of their ratings of compassion, sympathy, and pity, average  $r = .75, p < .001$ ). The means and intercorrelations of the composite and single item measures of observers' responses to bereaved participants are displayed in Table 6. The composite measures are presented in the first four rows.

As is evident in Table 6, observers judged bereaved participants to be suffering from moderate grief ( $M = 4.01$ ) and as seeming fairly well adjusted ( $M = 4.54$ ). Observers indicated that they would be inclined to offer help to the bereaved ( $M = 5.05$ ) and that they would not be inclined to avoid contact ( $M = 2.36$ ) with the bereaved. As one would imagine, observers reported moderately high levels of compassion ( $M = 4.19$ ) and sadness ( $M = 3.72$ ) in response to the bereaved, along with low levels of frustration ( $M = 1.16$ ), amusement ( $M = 0.49$ ), and happiness ( $M = 0.66$ ). Observers' judgments of the bereaved participants' suffering were negatively correlated with how well adjusted they judged the bereaved participants to be ( $r = -.68, p < .01$ ) and positively correlated with observers'

Table 6  
Means and Interitem Correlations of Observers' Responses

Measure	M	1	2	3	4	5	6	7	8	9	10
1. Perceived adjustment	4.54	—									
2. Offer comfort	5.05	-.02	—								
3. Avoid contact	2.36	-.24	.20	—							
4. Compassion	4.19	-.32	.60	.07	—						
5. Perceived suffering	4.01	-.68	.10	-.02	.38	—					
6. Sadness	3.72	-.40	.47	.14	.76	.47	—				
7. Amusement	0.49	.38	-.19	-.09	-.07	-.13	-.12	—			
8. Happiness	0.66	.43	.20	-.19	.19	-.26	.10	.49	—		
9. Positive emotion	0.57	.46	-.02	-.15	.05	-.22	-.02	.89	.84	—	
10. Frustration	1.16	-.38	-.25	.09	.15	.18	.23	-.26	-.35	-.34	—

Note. If  $|r| > .35$ , then  $p < .01$ . If  $|r| > .31$ , then  $p < .05$ . If  $|r| > .26$ , then  $p < .10$ .

Table 7  
*Observers' Responses to Laughters and Nonlaughters*

Observer's response	Duchenne laughters ( <i>n</i> = 21)		Nonlaughters ( <i>n</i> = 18)		<i>t</i> (37)	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Perceptions and actions						
Perceived suffering	3.72	1.01	4.35	1.23	1.74	<.09
Perceived adjustment	4.77	0.89	4.28	1.06	1.55	<.15
Comfort	4.82	0.74	5.31	0.78	2.03	<.05
Avoidance	2.39	0.71	2.32	0.53	0.35	<i>ns</i>
Emotions						
Compassion	3.85	1.36	4.59	1.46	1.65	<.15
Sadness	3.55	1.35	3.93	1.80	0.75	<i>ns</i>
Frustration	0.92	0.72	1.44	0.76	2.20	<.05
Amusement	0.74	1.08	0.20	0.36	4.04	<.05
Happiness	0.81	0.77	0.48	0.67	1.41	<i>ns</i>
Positive emotion	0.78	0.79	0.34	0.48	4.04	<.05

self-reports of compassion ( $r = .38, p < .05$ ) and sadness ( $r = .47, p < .01$ ). In contrast, observers' judgments that the bereaved participants were well adjusted were negatively correlated with their self-reports of compassion ( $r = -.32, p < .05$ ), sadness ( $r = -.40, p < .05$ ), and frustration ( $r = -.38, p < .05$ ) and were positively correlated with their self-reports of amusement ( $r = .38, p < .05$ ) and happiness ( $r = .43, p < .05$ ). Not surprisingly, observers' self-reported inclination to offer help was correlated with their feelings of compassion ( $r = .60, p < .01$ ) and sadness ( $r = .47, p < .01$ ).

Our final predictions specified that Duchenne laughter would evoke positive emotions and inferences in observers. Table 7 and Table 8 present the group comparisons and correlations relevant to these last predictions. The MANOVA revealed that across the individual measures of observers' inferences and emotions, observers responded to the Duchenne laughters and nonlaughters in different ways,  $F(10, 28) = 2.69, p < .05$ . Consistent with hypothesis, observers felt more amusement in response to the Duchenne laughters than the nonlaughters, ( $M_s = 0.74$  vs.  $0.20$ ),  $t(37) = 4.04, p < .05$ , as well as more overall positive emotion, ( $M_s = 0.78$  vs.  $0.34$ ),  $t(37) = 4.04, p < .05$ . A

marginally significant effect indicated that observers judged Duchenne laughters, compared with nonlaughters, to be suffering less, ( $M_s = 3.72$  vs.  $4.35$ ),  $t(37) = 1.74, p < .10$ . In contrast, observers felt greater frustration in response to the nonlaughters, ( $M_s = 1.44$  vs.  $0.92$ ),  $t(37) = 2.20, p < .05$ . Interestingly, observers tended to feel greater compassion ( $M_s = 4.59$  vs.  $3.85$ ),  $t(37) = 1.65, p = .11$ , in response to the nonlaughters, and they also indicated a greater inclination to offer help to the nonlaughters than to the Duchenne laughters, ( $M_s = 5.31$  vs.  $4.82$ ),  $t(37) = 2.03, p < .05$ . There were no differences in observers' indicated tendency to avoid contact with the Duchenne laughters or nonlaughters ( $p > .15$ ).

The correlations between the measures of expressive behavior and observers' perceptions yielded fairly similar results. Duchenne laughter was significantly correlated with perceptions of reduced suffering ( $r = -.35, p < .05$ ), increased adjustment ( $r = .31, p < .05$ ), and observers' increased feelings of amusement ( $r = .36, p < .05$ ) and reduced feelings of frustration ( $r = -.33, p < .05$ ). Non-Duchenne laughter was not correlated with observers' judgments of psychological adjustment or their emotional responses to the bereaved participants (all  $p_s > .15$ ).

Table 8  
*Correlations Between Measures of Laughter, Smiling Behavior, and Observers' Responses*

Observer's response	Duchenne laughter	Non-Duchenne laughter	Duchenne smile	Non-Duchenne smile
Perceived suffering	-.35*	.08	-.25	.15
Perceived adjustment	.31*	.12	.32*	-.24
Comfort	-.24	-.08	-.20	-.33**
Avoidance	.00	-.22	-.26	.18
Compassion	-.24	-.01	-.17	-.26†
Sadness	-.09	-.05	-.14	-.24
Frustration	-.33*	-.16	-.22	.23
Amusement	.36*	-.03	.27†	.14
Happiness	.29*	-.27†	.48**	-.23
Positive emotion	.38*	-.16	.42**	.05

†  $p < .10$  (marginally significant). \*  $p < .05$ . \*\*  $p < .01$ .

The measure of Duchenne smiles was correlated with perceptions of increased adjustment ( $r = .32, p < .05$ ) and observers' self-reports of increased happiness ( $r = .48, p < .01$ ).

### *Unique Relations Between Duchenne Laughter and the Outcome Measures Controlling for Duchenne Smiling*

To determine whether Duchenne laughter relates to intrapersonal and interpersonal processes independent of Duchenne smiling, we examined the correlations between Duchenne laughter and the different measures with Duchenne smiling partialled out. First, it should be noted that the correlation between the measures of Duchenne laughter and smiling were significant ( $r = .35, p < .05$ ). With Duchenne smiling partialled out, Duchenne smiling was still significantly correlated with self-reports of reduced anger ( $r = -.44, p < .01$ ), reduced distress ( $r = -.24, p < .10$ ), reduced overall negative emotion ( $r = -.38, p < .01$ ), increased joy ( $r = .25, p < .10$ ), the verbal autonomic dissociation score ( $r = -.31, p < .05$ ), the difference between self-reports of positive and negative emotion ( $r = .33, p < .05$ ), DAS consensus ( $r = .35, p < .01$ ), ambivalence in a current relation ( $r = .31, p = .05$ ), and observers' judgments that the bereaved participant was suffering ( $r = -.28, p < .10$ ) and observers' self-reported feelings of amusement ( $r = .30, p = .06$ ), frustration ( $r = -.25, p < .10$ ), and overall positive emotion ( $r = .26, p < .10$ ).

## Discussion

On the basis of theories of humor (Martin & Lefcourt, 1983; McGhee, 1979) and positive emotion (Levenson, 1988; Tomkins, 1984), as well as previous research linking laughter to improved long-term functioning during bereavement (Bonanno & Keltner, 1997), we hypothesized that laughter during bereavement would relate to the dissociation from psychological distress and to enhanced social relations. In testing these hypotheses, we addressed three questions about laughter that have received little empirical attention. First, is laughter related to the dissociation from distress and enhanced personal relations, as is widely assumed? Second, does the distinction between Duchenne and non-Duchenne smiles meaningfully account for the heterogeneity of laughter? Third, is laughter related to different processes than smiling, as claimed by certain ethologists?

### *Intrapersonal Processes Associated With Laughter*

Theories of emotion and humor propose that during stressful situations, laughter accompanies the dissociation from the subjective experience of distress, occurring as a shift from negative to positive emotion (Tomkins, 1984), from danger to safety (Rothbart, 1973), or from incongruous information to insight and understanding (Dixon, 1980; Martin & Lefcourt, 1983). This proposition has produced little empirical research, in part because of the difficulties inherent to the study of processes related to the regulation of and changes in conscious awareness (Wegner & Pennebaker, 1993) and because few studies have examined actual laughter. The present study found, consistent with the hypothesized dissociative nature of laughter, that Duchenne laughter observed during a stressful interview about the

death of a spouse was related to (a) the reduced experience of negative emotion, and in particular anger, (b) the increased experience of positive emotion, and (c) higher scores on a validated behavioral measure of the dissociation of awareness of distress (Bonanno et al., 1995). Non-Duchenne laughter, in contrast, related to a sensitized awareness of distress, suggesting that it may have been a laugh acknowledging the feelings of distress (see Ekman & Friesen, 1982, for related discussion of the miserable smile).

Although these findings represent the first evidence linking laughter to dissociation, one must keep in mind several caveats. First, the relations between laughter and dissociation may be most pronounced during times of trauma and in people willing to discuss the trauma—both characteristics of our study—and less so in other contexts and people. Second, our study was correlational in nature and did not allow us to examine the underlying mechanisms that account for the relationship between laughter and dissociation. We offer the following speculative explanations. Duchenne laughter may be accompanied by physiological and behavioral responses, including relaxed posture, changes in respiration (Ruch, 1993), and the release of neurotransmitters or activation of brain regions (see Weisfeld, 1993, for speculations), that might collectively counteract or “undo” the responses of negative emotion, thereby facilitating a transition to a positive state. Additionally, Duchenne laughter may be the outcome of cognitive processes in which the individual develops a new, alternative interpretation of the distressing event, which in turn brings about positive emotion (e.g., Dixon, 1980). To address these questions about mechanism and cause and effect relations it will be necessary to study the temporal relations between laughter and physiological, behavioral, and cognitive responses—a difficult but promising line of inquiry.

### *Interpersonal Processes Associated With Laughter*

The present study also generated evidence relevant to the widely assumed social benefits of laughter. Consistent with the hypothesized link between laughter and enhanced social bonds, Duchenne laughter was associated with recollections of increased relationship adjustment with the deceased spouse and with reduced ambivalence toward a current important other. The retrospective nature of these findings and their limitations led us to gather evidence related to the nature of social inferences, inclinations, and emotions that laughter evokes in other people. Duchenne laughter was associated with more positive emotion in observers and with observers' judgments that the participant was healthier, better adjusted, less frustrating, and more amusing, pointing to specific processes that account for why laughter enhances social bonds (e.g., Coseriu, 1960). These findings are particularly noteworthy when one considers that laughs and nonlaughs differed neither in their personality nor in the other emotions they displayed and that observers had only participants' expressive behavior, and not their speech, on which to base their inferences and responses.

We believe that observers' judgments capture an important way in which laughter facilitates the adjustment to stressful events. Laughter enhances social relations in many ways, rewarding others for desirable actions, serving as praise, dramatizing conversation, and even increasing physical proximity (Weis-

feld, 1993). These social benefits of laughter are likely to enable bereaved individuals to engage in pleasurable social interactions, which in part was indicated by Duchenne laughers' reduced ambivalence in an important current relation. The same may be true of other transient and more stable periods of distress and disturbance: Depressed, hostile, and highly neurotic individuals may engage in more difficult, distressing interactions because they laugh less, thus creating contexts that perpetuate their condition, state, or trait (Keltner, 1996). Interestingly, although bereaved individuals in previous studies have been critical of the support they received from others (Nuss & Zubenko, 1992), in the present study observers responded to those bereaved participants who did not laugh with the increased inclination to offer comfort and with feelings of compassion, an emotion with well-known social benefits, including altruistic helping (Eisenberg et al., 1989). Thus, the salutary influence of laughter during bereavement may be accompanied by the unfortunate side effect of reducing others' inclination to offer comfort and support.

### *Laughter and Smiling*

Research on human emotion has focused on the differentiation of the negative emotions. In contrast, strikingly little is known about the characteristics and functions of the positive emotions. Certain ethologists have offered a point of departure for speculations about positive emotions in humans, claiming that laughter and smiling originate in different displays of non-human primates that are distinct in their form, eliciting contexts, and social consequences (e.g., Chevalier-Skolnikoff, 1973; Van Hooff, 1972). To thoroughly explore this possibility, as well as its counterpart that laughter and smiling represent different levels of intensity of the same positive emotion (e.g., Darwin, 1872), several lines of research are needed. Measurement of the contexts, experience, and physiology of laughter and smiling needs to be done to ascertain whether these facial displays relate to different emotional processes. With these considerations in mind, the current study offers preliminary evidence suggesting that laughter and smiling may relate to different emotional processes.

In certain analyses, laughter and smiling demonstrated similar correlates: Both were correlated with self-reports of increased overall positive emotion as well as with observers' attributions of increased psychological adjustment. Laughter and smiling differed, however, in the strength with which they were correlated with self-reports of certain emotions. Laughter was more strongly correlated than smiling with self-reports of reduced anger. Smiling, in contrast, was more strongly correlated with self-reports of reduced distress and fear. These findings bear a striking resemblance to Tomkins's observation that laughter accompanies the sudden reduction of anger, and the smile of joy, the sudden reduction of fear and distress (Tomkins, 1984). We believe that laughter and smiling frequently occur in purely positive contexts in which there is no antecedent negative emotion. Yet when positive emotions follow the reduction of negative emotions, the present evidence indicates that the nature of the initial emotion will significantly influence the ensuing positive emotion. To the extent that anger is reduced or "undone," laughter is likely to ensue; to the extent that distress is reduced sud-

denly or undone, smiling is likely to ensue. This speculation warrants further research.

Laughter also demonstrated different social correlates than smiling. Specifically, Duchenne laughter was related to recollections of increased relationship satisfaction with the deceased and with reduced ambivalence toward a current other, whereas smiling was not. Laughter and smiling also evoked different emotions in observers: Duchenne laughter was more strongly related to observers' increased amusement and reduced frustration, whereas Duchenne smiling was more strongly related to observers' happiness.

Other differences between laughter and smiling have been documented. For example, laughter is associated with greater elevations in heart rate than smiling (Ruch, 1993). Observers labeled photos of laughter as amusement and those of smiling as happiness (Keltner & Buswell, 1996). This body of evidence suggests that laughter and smiling may be associated with different positive emotions. The question is which ones, and for what reasons? Ethologists' observations that the open-mouth play face is associated with play, and the silent bared teeth display, the predecessor of smiling, with affiliation (Chevalier-Skolnikoff, 1973; Van Hooff, 1972) may provide an answer. Laughter may relate to play-related emotions, such as amusement or exhilaration, whereas smiling may relate to affiliation-related emotions, such as enjoyment or love. Play- and affiliation-related emotions may prove to have different social objects, contexts, physiological responses, and subjective experiences.

### *The Signal Value of Laughter*

Finally, the results of the present study bear on the recent debate regarding the signal value of facial expressions of emotion. Although most emotion theorists contend that facial expressions signal social intentions along with current feelings (e.g., Darwin, 1872; Ekman, 1984), it has recently been argued that the related experience of emotion is not essential to the communicative value of facial expressions (Fridlund, 1992). This point has been forcefully made in regard to laughter: "Because laughing and smiling are phasic social acts they are of limited value as indices of ongoing tonic emotional state" (Provine & Fischer, 1989, p. 295).

The current findings make two points vis-à-vis such claims. First, contrary to such claims, Duchenne laughter and Duchenne smiling were indeed correlated with self-reports of the experience of emotion, and in certain ways they indexed the experience of different emotions, as we described above. We contend, following other theorists (Ekman, 1992), that the social signal value of facial displays is actually enhanced by its association with the sender's experienced emotion, which increases the vividness and credibility of communication. The meanings that laughter conveys, from praise to the desire to continue ongoing social activity, are likely to be more credible, and more evocative, when associated with emotion. This observation actually received indirect support by the present study's findings: It was only Duchenne laughter, which was associated with the experience of emotion, that evoked specific judgments and responses in observers; non-Duchenne laughter, which did not relate to the experience of emotion, had little impact on observers.

Second, the findings from the current study point to the need

for greater precision in discussing different kinds of laughter when theorizing about this important category of expressive behavior. A wide array of often contradictory functions has been attributed to laughter, including the punctuation of conversation (Provine, 1993), the communication of aggression and superiority (e.g., Van Hooff, 1972), and the emotional functions that we have studied. Such diversity in description inevitably leads to theoretical debate about the nature of laughter, for example, whether laughter is necessarily associated with the experience of positive emotion. These theoretical tensions may simply be the product of the failure to make distinctions between Duchenne and non-Duchenne laughter, which the present study found to have much different intrapersonal and interpersonal correlates. Certain functions of laughter that seem to be independent of the experience of positive emotion, such as the punctuation of conversation or the expression of superiority, are likely to be the province of non-Duchenne laughter, whereas the positive functions served by laughter that have been the focus of this study are more likely to be served by Duchenne laughter. We hope this study prompts further research on these issues and, more generally, on the nature and functions of laughter and the positive emotions.

## References

- Apte, M. L. (1985). *Humor and laughter: An anthropological approach*. Ithaca, NY: Cornell University Press.
- Arendt, H. (1986). Communicative power. In S. Lukes (Ed.), *Power* (pp. 59–74). New York, NY: New York University Press. (Original work published 1969)
- Asendorpf, J. B., & Scherer, K. R. (1983). The discrepant repressor: Differentiation between low anxiety, high anxiety, and repression of anxiety by autonomic–facial–verbal patterns of behavior. *Journal of Personality and Social Psychology*, 45, 1334–1346.
- Bateson, G. (1969). The position of humor in human communication. In J. Levine (Ed.), *Motivation in humor* (pp. 159–166). New York: Atherton.
- Baxter, L. A. (1992). Forms and functions of intimate play in personal relationships. *Human Communication Research*, 18, 336–363.
- Bernstein-Carlson, E. B., & Putnam, F. W. (1986). Development, reliability, and validity of a dissociation scale. *Journal of Nervous and Mental Disease*, 174, 727–735.
- Bonanno, G. A. (1995). Accessibility, reconstruction, and the treatment of functional memory problems. In A. D. Baddeley, B. A. Wilson, & F. N. Watts (Eds.), *Handbook of functional memory disorders* (pp. 615–637). New York: Wiley.
- Bonanno, G. A. (in press). The concept of “working through” loss: A critical evaluation of the cultural, historical, and empirical evidence. In A. Maercker, M. Schuetzwohl, & Z. Solomon (Eds.), *Posttraumatic stress disorder: Vulnerability and resilience in the life-span*. Seattle, WA: Hograth & Huber.
- Bonanno, G. A., Gunzerath, L., Notarius, C. I., Keltner, D., & Horowitz, M. J. (1996). *Interpersonal ambivalence, perceived dyadic adjustment, and conjugal loss*. Manuscript submitted for publication.
- Bonanno, G. A., & Keltner, D. (1997). Facial expressions of emotion and the course of conjugal bereavement. *Journal of Abnormal Psychology*, 106, 126–137.
- Bonanno, G. A., Keltner, D., Holen, A., & Horowitz, M. J. (1995). When avoiding unpleasant emotions might not be such a bad thing: Verbal–autonomic response dissociation and midlife conjugal bereavement. *Journal of Personality and Social Psychology*, 69, 975–989.
- Carver, C. S., Pozo, C., Harris, S. D., Noriega, V., Scheier, M. F., Robinson, D. S., Ketcham, A. S., Moffat, F. L., Jr., & Clark, K. C. (1993). How coping mediates the effect of optimism on distress: A study of women with early stage breast cancer. *Journal of Personality and Social Psychology*, 65, 375–390.
- Chevalier-Skolnikoff, S. (1973). Facial expression of emotion in nonhuman primates. In P. Ekman (Ed.), *Darwin and facial expression* (pp. 11–90). New York: Academic Press.
- Coser, R. L. (1959). Some social functions of laughter. *Human Relations*, 12, 171–182.
- Coser, R. L. (1960). Laughter among colleagues. *Psychiatry*, 23, 81–95.
- Costa, P. T., & McCrae, R. R. (1980). Influence of extraversion and neuroticism on subjective well-being: Happy and unhappy people. *Journal of Personality and Social Psychology*, 38, 668–678.
- Costa, P. T., & McCrae, R. R. (1992). *Revised NEW Personality Inventory (NEO-PIR) and NEW Five Factor Inventory (NEO-FFI) professional manual*. Odessa, FL: Psychological Assessment Resources.
- Coyne, J. C. (1976). Depression and response to others. *Journal of Abnormal Psychology*, 85, 186–193.
- Danzer, A., Dale, J. A., & Klions, H. L. (1990). Effect of exposure to humorous stimuli on induced depression. *Psychological Reports*, 66, 1027–1036.
- Darwin, C. (1872). *The expression of the emotions in man and animals*. London: Murray.
- Deutsch, H. (1937). Absence of grief. *Psychoanalytic Quarterly*, 6, 12–22.
- Dixon, N. F. (1980). Humor: A cognitive alternative to stress? In I. G. Sarason & C. D. Spielberger (Eds.), *Stress and anxiety* (Vol. 7, pp. 281–289). Washington, DC: Hemisphere.
- Duchenne de Bologne, G. B. (1862). *The mechanism of human facial expression* (R. A. Cuthbertson, Trans.). New York: Cambridge University Press.
- Eisenberg, N., Fabes, R. A., Miller, P. A., Fultz, J., Shell, R., Mathy, R. M., & Reno, R. R. (1989). Relation of sympathy and personal distress to prosocial behavior: A multimethod study. *Journal of Personality and Social Psychology*, 57, 55–66.
- Ekman, P. (1984). Expression and the nature of emotion. In K. Scherer & P. Ekman (Eds.), *Approaches to emotion* (pp. 319–344). Hillsdale, NJ: Erlbaum.
- Ekman, P. (1992). An argument for basic emotions. *Cognition and Emotion*, 6, 169–200.
- Ekman, P., & Friesen, W. V. (1976). Measuring facial movement. *Journal of Environmental Psychology and Nonverbal Behavior*, 1, 56–75.
- Ekman, P., & Friesen, W. V. (1978). *Facial action coding system: A technique for the measurement of facial movement*. Palo Alto, CA: Consulting Psychologists Press.
- Ekman, P., & Friesen, W. V. (1982). Felt, false, and miserable smiles. *Journal of Nonverbal Behavior*, 6, 238–252.
- Ekman, P., Friesen, W. V., & Ancoli, S. (1980). Facial signs of emotional experience. *Journal of Personality and Social Psychology*, 39, 1125–1134.
- Ekman, P., Friesen, W. V., & O’Sullivan, M. (1988). Smiles when lying. *Journal of Personality and Social Psychology*, 54, 414–420.
- Erdelyi, M. H. (1985). *Psychoanalysis: Freud’s cognitive psychology*. New York: Freeman.
- Fowles, D. C. (1980). The three arousal model: Implications of Gray’s two-factor learning theory for heart rate, electrodermal activity, and psychopathy. *Psychophysiology*, 17, 87–104.
- Fox, N. A., & Davidson, R. J. (1988). Patterns of brain electrical activity during facial signs of emotion in ten-month-old infants. *Developmental Psychology*, 24, 230–236.
- Frank, M., Ekman, P., & Friesen, W. V. (1993). Behavioral markers and recognizability of the smile of enjoyment. *Journal of Personality and Social Psychology*, 64, 83–93.

- Freud, S. (1957). Mourning and melancholia. In J. Strachey (Ed.), *The standard edition of the complete psychological works of Sigmund Freud* (Vol. 14, pp. 152–170). London: Hogarth Press. (Original work published 1917)
- Freud, S. (1959). Humor. In Strachey, J. (Ed.), *Collected papers of Sigmund Freud* (Vol. 5). New York: Basic Books. (Original work published 1928)
- Fridlund, A. J. (1992). The behavioral ecology and sociality of human faces. In M. S. Clark (Ed.), *Emotion* (pp. 90–121). Newbury Park, CA: Sage.
- Goodall, J. (1968). The behavior of free-living chimpanzees in the Gombe Stream Reserve. *Animal Behavior Monographs*, 1, 165–311.
- Gross, J. J., Fredrickson, B. L., & Levenson, R. W. (1994). The psychophysiology of crying. *Psychophysiology*, 31, 460–468.
- Hampes, W. P. (1994). Relation between intimacy and the multidimensional sense of humor scale. *Psychological Reports*, 74, 1360–1362.
- Harber, K. D., & Pennebaker, J. W. (1992). Overcoming traumatic memories. In S. A. Christianson (Ed.), *The handbook of emotion and memory* (pp. 359–388). Hillsdale, NJ: Erlbaum.
- Hatfield, E., Cacioppo, J. T., & Rapson, R. (1992). Primitive emotional contagion. *Review of Personality and Social Psychology*.
- Hayworth, D. (1928). The social origin and function of laughter. *Psychological Review*, 35, 367–384.
- Hilgard, J. R. (1986). Divided consciousness: Multiple controls on human thought and action. New York: Wiley.
- Hinde, R. A. (1974). *Biological bases of human social behavior*. New York: McGraw-Hill.
- Horowitz, M. J., Siegel, B., Holen, A., Bonanno, G. A., Milbrath, C., & Stinson, C. H. (1996). *Diagnostic criteria for complicated grief disorders*. Unpublished manuscript. University of California, San Francisco.
- James, W. (1890). *The principles of psychology* (Vols. 1–2). New York: Dover.
- Keltner, D. (1995). The signs of appeasement: Evidence for the distinct displays of embarrassment, amusement, and shame. *Journal of Personality and Social Psychology*, 68, 441–454.
- Keltner, D. (1996). Facial expressions of emotion and personality. In C. Malatesta-Magai & S. H. McFadden (Eds.), *Handbook of emotion, aging, and the lifecourse* (pp. 385–402). New York: Academic Press.
- Keltner, D., Bonanno, G. A., Caspi, A., Krueger, R., & Stouthamer-Loeber, M. (1996). *Personality and facial expressions of emotion*. Manuscript submitted for publication, University of California, Berkeley.
- Keltner, D., & Buswell, B. N. (1996). Evidence for the distinctness of embarrassment, shame, and guilt: A study of recalled antecedents and facial expressions of emotion. *Cognition and Emotion*, 10, 155–171.
- Keltner, D., & Ekman, P. (1994). Facial expressions of emotion: Old questions and new findings. *Encyclopedia of human behavior* (Vol. 2, pp. 361–369). Academic Press.
- Keltner, D., & Monarch, N. M. (1996). *Emotion, personality, and relationship satisfaction in romantic couples*. Manuscript in preparation, University of California, Berkeley.
- Kessler, R. C., Kendler, K. S., Heath, A., Neale, M. C., & Eaves, L. J. (1992). Social support, depressed mood, and adjustment to stress: A genetic epidemiologic investigation. *Journal of Personality and Social Psychology*, 62, 257–272.
- Krohne, H. W. (1992). Vigilance and cognitive avoidance as concepts in coping research. In H. W. Krohne (Ed.), *Attention and avoidance strategies in coping with aversiveness* (pp. 19–50). Göttingen, Germany: Hogrefe & Huber.
- Krokoff, L. J. (1991). Job distress is no laughing matter in marriage, or is it? *Journal of Social and Personal Relationships*, 8, 5–25.
- Kuiper, N. A., Martin, R. A., & Dance, K. A. (1992). Sense of humour and enhanced quality of life. *Personality and Individual Differences*, 13, 1273–1283.
- Lang, P. J., Levin, D. N., Miller, G. A., & Kozak, M. J. (1983). Fear behavior, fear imagery, and the psychophysiology of emotion: The problem of affective response integration. *Journal of Abnormal Psychology*, 92, 276–306.
- Lazare, A. (1989). Bereavement and unresolved grief. In A. Lazare (Ed.), *Outpatient psychiatry: Diagnosis and treatment* (2nd ed., pp. 381–397). Baltimore: Williams & Wilkins.
- Lazarus, R. S. (1966). *Psychological stress and the coping process*. New York: McGraw-Hill.
- Lazarus, R. S. (1991). *Emotion and adaptation*. New York: Oxford University Press.
- Lehman, D. R., Ellard, J. H., & Wortman, C. B. (1986). Social support for the bereaved: Recipients' and providers' perspectives on what is helpful. *Journal of Consulting and Clinical Psychology*, 54, 438–456.
- Levenson, R. W. (1988). Emotion and the autonomic nervous system: A prospectus for research on autonomic specificity. In H. Wagner (Ed.), *Social psychophysiology and emotion: Theory and clinical applications* (pp. 17–42). London: Wiley.
- Leventhal, H. (1984). A perceptual motor theory of emotion. In K. R. Scherer & P. Ekman (Eds.), *Approaches to emotion* (pp. 271–291). Hillsdale, NJ: Erlbaum.
- Leventhal, H. (1991). Emotion: Prospects for conceptual and empirical development. In R. G. Lister & H. J. Weingartner (Eds.), *Perspectives on cognitive neuroscience* (pp. 325–348). Oxford, England: Oxford University Press.
- Lindemann, E. (1944). Symptomatology and management of acute grief. *American Journal of Psychiatry*, 101, 1141–1148.
- Maddison, D. C., & Walker, W. L. (1967). Factors affecting the outcome of conjugal bereavement. *British Journal of Psychiatry*, 113, 1057–1067.
- Martin, R. A. (1989). Humour and the mastery of living: Using humour to cope with the daily stresses of growing up. In P. E. McGhee (Ed.), *Humour and children's development: A guide to practical applications* (pp. 135–154). New York: Haworth Press.
- Martin, R. A., & Lefcourt, H. M. (1983). The sense of humor as a moderator of the relation between stressors and moods. *Journal of Personality and Social Psychology*, 45, 1313–1324.
- Mayer, J. D., & Gaschke, Y. N. (1988). The experience and meta-experience of mood. *Journal of Personality and Social Psychology*, 55, 102–111.
- McGhee, P. E. (1979). *Humor: Its origin and development*. San Francisco: Freeman.
- Merikle, P. M., & Reingold, E. M. (1992). Measuring unconscious perceptual processes. In R. F. Bornstein & T. S. Pittman (Eds.), *Perception without awareness* (pp. 55–80). New York: Guilford Press.
- Newton, T. L., & Contrada, R. J. (1992). Repressive coping and verbal-autonomic dissociation: The influence of social context. *Journal of Personality and Social Psychology*, 62, 159–167.
- Nezu, A. M., Nezu, C. M., & Blissett, S. E. (1988). Sense of humor as a moderator of the relation between stressful events and psychological distress: A prospective analysis. *Journal of Personality and Social Psychology*, 54, 520–525.
- Nuss, W. S., & Zubenko, G. S. (1992). Correlates of persistent depressive symptoms in widows. *American Journal of Psychiatry*, 149, 346–351.
- Overholser, J. C. (1992). Sense of humor when coping with life stress. *Personality and Individual Differences*, 13, 799–804.
- Preuschoft, S. (1995). *'Laughter' and 'smiling' in Macaques: An evolutionary perspective*. Unpublished doctoral dissertation, University of Utrecht, Utrecht, the Netherlands.
- Provine, R. R. (1992). Contagious laughter: Laughter is a sufficient



- stimulus for laughs and smiles. *Bulletin of the Psychonomic Society*, 30, 1-4.
- Provine, R. R. (1993). Laughter punctuates speech: Linguistic, social, and gender contexts of laughter. *Ethology*, 95, 291-298.
- Provine, R. R., & Fischer, K. R. (1989). Laughing, smiling, and talking: Relation to sleeping and social context in humans. *Ethology*, 83, 295-305.
- Putnam, F. W. (1989). Pierre Janet and modern views of dissociation. *Journal of Traumatic Stress*, 2, 413-429.
- Raphael, B. (1983). *The anatomy of bereavement*. New York: Basic Books.
- Redican, W. K. (1982). An evolutionary perspective on human facial displays. In P. Ekman (Ed.), *Emotion in the human face* (pp. 212-280). Cambridge, England: Cambridge University Press.
- Rothbart, M. L. (1973). Laughter in young children. *Psychological Bulletin*, 80, 247-256.
- Ruch, W. (1993). Exhilaration and humor. In M. Lewis & J. M. Haviland (Eds.), *The handbook of emotion* (pp. 605-616). New York: Guilford Press.
- Salameh, W. A. (1983). Humor in psychotherapy: Past outlooks, present status, and future frontiers. In P. E. McGhee & J. H. Goldstein (Eds.), *Handbook of humor research* (Vol. 2, pp. 61-86). New York: Springer-Verlag.
- Sanders, C. M. (1993). Risk factors in bereavement outcome. In M. S. Stroebe, W. Stroebe, & R. O. Hanson (Eds.), *Handbook of bereavement: Theory, research, and intervention* (pp. 255-270). Cambridge, England: Cambridge University Press.
- Schwartz, G. E., Fair, P. L., Salt, P., Mandel, M. R., & Klerman, G. L. (1976). Facial muscle patterning to affective imagery in depressed and nondepressed subjects. *Science*, 192, 489-491.
- Shuchter, S. R., & Zisook, S. (1993). The course of normal grief. In M. S. Stroebe, W. Stroebe, & R. O. Hanson (Eds.), *Handbook of bereavement: Theory, research, and intervention* (pp. 23-43). Cambridge, England: Cambridge University Press.
- Singer, J. L. (1966). *The inner world of daydreaming*. New York: Harper & Row.
- Spanier, G. B. (1976). Measuring dyadic adjustment: New scales for assessing the quality of marriage and similar dyads. *Journal of Marriage and the Family*, 38, 15-28.
- Sroufe, L. A., & Wunsch, J. C. (1972). The development of laughter in the first year of life. *Child Development*, 43, 1326-1344.
- Stroebe, M. S., & Stroebe, W. (1991). Does "grief work" work? *Journal of Consulting and Clinical Psychology*, 59, 479-482.
- Stroebe, W., & Stroebe, M. S. (1987). *Bereavement and health*. Cambridge, England: Cambridge University Press.
- Sumitsuji, N. (1967). Electromyographic studies on the facial expression. *Psychiatria et Neurologia Japonica*, 69, 1101-1119.
- Temoshok, L. (1987). Personality, coping style, emotion and cancer: Towards an integrative model. *Cancer Surveys*, 6, 545-567.
- Tomkins, S. S. (1984). Affect theory. In P. Ekman & K. Scherer (Eds.), *Approaches to emotion* (pp. 163-196). Hillsdale, NJ: Erlbaum.
- Van Hooff, J. A. R. A. M. (1972). A comparative approach to the phylogeny of laughter and smiling. In R. A. Hinde (Ed.), *Nonverbal communication* (pp. 209-237).
- Veldern, M., & Graham, F. K. (1988). *Journal of Psychophysiology*, 2, 277-282.
- Vinton, K. L. (1989). Humor in the work place: Is it more than telling jokes. *Small Group Behavior*, 20, 151-166.
- Watson, D., & Clark, L. A. (1992). On traits and temperament: General and specific factors of emotional experience and their relation to the five-factor model. *Journal of Personality*, 60, 441-476.
- Wegner, D. M., & Pennebaker, J. W. (1993). Changing our minds: An introduction to mental control. In D. M. Wegner & J. W. Pennebaker (Eds.), *Handbook of mental control* (pp. 1-12). New York: Prentice Hall.
- Weinberger, D. A., & Davidson, M. N. (1994). Styles of inhibiting emotional expression: Distinguishing repressive coping from impression management. *Journal of Personality*, 62, 587-613.
- Weinberger, D. A., Schwartz, G. E., & Davidson, R. J. (1979). Low-anxious and repressive coping styles: Psychometric patterns of behavioral and physiological responses to stress. *Journal of Abnormal Psychology*, 88, 369-380.
- Weisfeld, G. E. (1993). The adaptive value of humor and laughter. *Ethology and Sociobiology*, 14, 141-169.
- Wortman, C. B., & Silver, R. C. (1989). The myths of coping with loss. *Journal of Personality and Social Psychology*, 57, 349-357.
- Yerkes, R. M. (1943). *Chimpanzees: A laboratory colony*. New Haven, CT: Yale University Press.
- Ziv, A., & Gadish, O. (1989). Humor and marital satisfaction. *Journal of Social Psychology*, 129, 759-768.

Received November 12, 1996

Revision received April 16, 1997

Accepted April 16, 1997 ■