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Facial Expressions During Marital Conflict

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A sample of 79 married couples were studied in 1983 in our laboratory engaging in a marital conflict discussion. Their facial expressions were coded from video tape using the Ekman and Friesen (1978) Emotion Facial Affect Coding System. This article describes the validity of this coding in several measurement domains: (a) the couple's perception of the relationship; (b) the prediction of the number of months of marital separation within the next 4 years; (c) the couple's physical health within the next 4 years; (d) the couple's cardiac physiological responses during the conflict interaction (interbeat interval and pulse transit time); (e) the number of floor switches or interacts in the conflict conversation; and (f) coding of the couple's Oral History Interview, which assesses dimensions of the couple's relationship history and philosophy. Facial expressions were consistently related to most domains of measurement.

The idea that facial expressions of emotion would be interesting to study during marital interaction is quite new. This might be surprising, except for two additional facts. First, faces have primarily been studied in individuals in response to specific

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eliciting stimuli, not during unrestrained social interaction (for a review see Gottman, 1993). Studying emotions in the context of relationships is a new concept. They have primarily been studied as characteristics of the individual. Indeed, Berscheid (1999) noted that what she called *relationship science* "requires a departure from business as usual for psychological researchers. It especially requires surmounting the *individualistic* orientation to human behavior that historically has pervaded the field" (p. 261).

Now that we have entered the 21st century, we suggest that relationship science will be the next important development. Psychology has traditionally been primarily a science of the individual; it has become more so with the cognitive neuroscience revolution. For psychology the relationship is too big a unit of study, and for sociology the relationship has been too small a unit of study. Sociology's main interest is in units such as class, race, and political units. This new relationship science will be centrally about the study of emotional communication as it unfolds over time.

Second, the study of affect itself in marriages has had a long and somewhat tortured history. We will briefly review that history.

In the 1930s the concept of considering social interaction and not the individual personality as the focus of study or treatment of married couples was unknown, and the idea of doing conjoint therapy with couples was actually considered unethical by the clinical community (for a review see Gottman, 1979).

The prevailing mode of therapy in the 1930s was individual therapy, and conjoint therapy was then widely considered a violation of confidentiality, and ill-advised for other reasons. Freud had done two simultaneous individual psychoanalytic therapies with a married couple, and, for some unknown reason it was a disaster for him; he recommended in 1912 that no analyst see two married partners at the same time. In fact, he wrote, "When it comes to the treatment of relationships, I must confess myself at an utter loss" (Freud, 1912). His frustration and casual recommendation later became dogma.

Only Ackerman (1966) had the audacity to suggest that two neurotics could have a happy marriage without curing the neuroses of either partner, and for that heresy he was essentially rejected by the therapeutic community. His ideas were counter to the prevailing notion that all human problems must be treated by changing the individual mind through psychoanalysis. Much the same prevailing idea exists today, except that it has been replaced with a brain function and neurological approach to treatment. But in the 1930s Ackerman suggested that interaction and not the individual personalities of the spouses be the subject of treatment. It was a revolutionary idea that was not taken seriously for nearly 30 years.

In the 1960s family systems thinkers, following von Bertalanffy's (1968) ideas, began their theorizing about family relationships by suggesting that, as Ackerman had suggested earlier, it was social interaction, and specifically the clarity of communication that should be targeted by therapists. They suggested that in pathologi-

cal families (initially defined by one member having a psychiatric classification), confusing messages such as double bind messages were sent, in which various verbal and/or nonverbal channels might contradict one another, or people "mindread" their partners, never checking out fundamental assumptions (Bateson, Jackson, Haley, & Weakland, 1956; Watzlawick, Beavin, & Jackson, 1967). In fact, they proposed that the inability to escape these confusing messages created or even was the psychopathology. It was an exciting suggestion.

In this view the therapist became a cybernetic engineer of the family system, providing missing corrective feedback loops, or teaching the family to communicate about the processes of communication (called meta-communication). It led to an intellectually sparkling and exciting set of therapy books that elaborated this role of the family and marital therapist as a communications expert.

The communication clarity theory of general systems theorists was a fascinating hypothesis, and historically it was important that it be proposed. In the marital area tests of the systems view needed to wait until the 1970s when observational research began to be applied to the study of distressed and happy marriages. Unfortunately, in couples interaction it was not supported by empirical research. Research showed that it was not the case that in distressed compared to nondistressed marriages, for example, that people were unclear in their communication, nor did they meta-communicate less often (Gottman, 1979).

The empirical truth that emerged from the observational study of couples was that distressed marriages compared to nondistressed marriages were simply far more negative toward one another. Measures of their interaction as judged independent outside observers (who were reliable with respect to each other) confirmed the fact that people in distressed marriages were far more negative toward one another than people in nondistressed marriages (Weiss, Hops, & Patterson, 1973). This was true regardless of whether verbal or nonverbal behavior was studied, but nonverbal channels were better at making these discriminations because distressed couples could fake being happily married using just words (in the verbal channel) but not in the nonverbal channels (Vincent, Friedman, Nugent, & Messerly, 1979). For example, in a distressed marriage a spouse might say "Well honey, how was your day?" but the question somehow sounded sarcastic; maybe the word "honey" was stressed a bit too much, or used some other cue was employed to convey the unintended negativity. Try as they might to conceal it, the negativity leaked through in the nonverbal channels.

For unhappily married husbands, this negativity extended to a distorted perception of the nonverbal component of their partner's communication. When one controlled the verbal component of the message, the unhappily married husbands were able to correctly read other married women's nonverbal components but not those of their own wives' (Gottman & Porterfield, 1981; Noller, 1980).

Furthermore, in families apparently there was no real confusion or "double bind" about negativity. Bugenthal, Love, Kaswan, and April (1971) found that

even children were unconfused by the so-called "channel inconsistency," in which one channel of communication (e.g., the face) was positive and another channel (e.g., the voice, or people's words) were negative. Children simply appeared to give preference to whatever channel had the negative information and ignored the other channels. For example, a mother in a waiting room might simultaneously smile and impatiently warn her child to sit quietly. Later, this apparent "channel inconsistency" was reframed by Ekman (1982) using concepts such as "masking" and "display rules," which clarified these empirical results.

In the 1970s, Gottman and his associates built a "talk table" that made it possible to simultaneously assess both interactive behavior and people's perception of the intent and impact of their own and their partner's messages. They found that not only were the messages themselves far more negative in distressed than in nondistressed couples, but they were perceived that way as well (Gottman et al., 1976). Later, Robinson and Price (1980) reported that there was an interesting perceptual distortion about *positivity* in distressed couples compared to observers. Distressed couples saw only 50% of the positive behaviors of their partners that objective observers saw. Nondistressed couples and observers were veridical about positivity.

Unfortunately, this much simpler (and far less interesting) hypothesis about distressed couples being more negative and less positive toward one another (and perceiving more negativity) than nondistressed couples did not suggest as clear a model for the therapist as the cybernetic engineer model. The therapist could try to admonish people to be nicer to each other, and this is precisely what many behavioral marital therapists wound up doing in what came to be called "Behavior Exchange Marital therapy" (Stuart's, 1980, "caring days"). However, it turned out to be an ineffective therapy, when used by itself (Jacobson, Schmaling, & Holtzworth-Munroe, 1987). Furthermore, it seemed far too simplistic an approach.

The problem of using the negativity/positivity findings for building a therapy may not be solved until basic research on emotion is conducted, particularly work on the facial expressions of emotions, and then applied to the study of relationships. In this article we attempt to apply basic work on the facial expression of emotion to ongoing marital interaction to assess whether this approach might yield valid and useful data. To contextualize our work, we will briefly review the research on the facial coding of emotion.

In the 1970s a revolution in our understanding of emotion was generated by the evolutionary-based study of emotional expressions in the face, stimulated by the theorizing of Sylvan Tomkins and the empirical work of his students Paul Ekman and Caroll Izard. This research was, in some ways, a return to Darwin's (1872, 1998) book on the expression of emotions, which viewed facial expressions of emotion as central, and as having adaptive functions in terms of physiology (e.g., disgust closed the nostrils against inhaling potentially noxious odors) and social communication. Tomkins was a pioneer, because there was a

great deal of resistance and skepticism to studying the face at all. Bruner and Taguiri's (1954) review of literature called the face "a researcher's nightmare" and urged scientists to abandon the notion of facial measurement. This skepticism was only broken by the amazingly powerful book written by Ekman, Friesen, and Ellsworth (1972), in which they systematically demolished Taguiri and Bruner's review and presented new evidence on the hypothesis of the universality of facial production and recognition.

Initially, this work on faces was based on nonanatomical observational systems, such as Izard's MAX and Ekman and Friesen's FAST, but these systems were doomed by the enormous complexity of the human facial musculature. For example, Smith, and Connolly (1972) once defined a smile using the facial cue of upturned lip corners, but there are many facial expressions that have upturned lip corners that are clearly not smiles; for example, the cheek raiser muscle raises the lip corners during displays of physical pain. Also, there were many expressions that were clearly smiles in which the lip corners were turned down; a now classic example is the coy or inhibited smile created by a combination of two opposing facial muscles, cheek raiser, which raises the cheeks, and another muscle that depresses the lip corners.

In 1978, Ekman and Friesen designed the anatomically based Facial Action Coding System (FACS; Ekman & Friesen, 1978) and the study of emotions was then placed on a more rigorous and less subjective quantitative footing. Finally there was a language for describing facial action, using "action units" (AUs), which were based on the motion of specific muscle groups. Table 1 summarizes the AUs of the FACS. There are 33 AUs, most of which involve a single muscle. There are thousands of combinations of these AUs. For example, the "Darwin grief muscle" in the brow, which Darwin noted was indicative of distress and sadness, involves the inner corners of the brow being drawn up and together and creates an inverted-U set of medial wrinkles in the forehead. This combination of two AUs would be written in FACS notation as 1 + 4, because it involves the AU 1, inner brow raiser (Frontalis, pars medialis) and 4, brow lowerer (Depressor glabellae, depressor super cillii, and corrugator). It is interesting that most of the action in the face occurs around the mouth.

Particularly important for emotion in marital interaction in our experience have been the following 15 actions: 1, 4, 1 + 4, 1 + 2 + 4, 5, 6, 12, 7, 9, 10, 14 (left unilateral), 15, 16 + 25, 17, 20, 23, 24, and 1 + 2. The AUs 23 and 24 tend to be involved in expressions of anger; AUs 1 + 4 and 1 in Sadness or distress; AUs 1 + 2 + 4, 5, and 20 in Fear; AUs 9, 10, and 16 + 25 in Disgust; AU 14 in Contempt; AU 5 in surprise; AU 12 + 6 in Felt Happiness and 12 without 6 in Unfelt Happiness. The AU 7 has always seemed to be used as "close scrutiny," which depends on the context for emotional meaning. If the speaker is trying to convince the listener, it could mean doubt or suspicion, whereas if the speaker is talking about being distrustful of someone else, it could convey empathy. Camras (personal communication, 1980) noticed that in

TABLE 1
Action Units of the Human Face (Ekman & Friesen, 1978)

Unit	*Name*	*Facial Muscles*
1	Inner brow raiser	Frontalis pars medialis
2	Outer brow raiser	Frontalis pars lateralis
4	Brow lowerer	Depressor Glabellae, depressor super cillii, corrugator
5	Upper lid raiser	Levator Pal pebrae superioris
6	Cheek raiser	Orbicularis Oculi, Pars Orbitalis
7	Lid tightener	Orbicularis Oculi, Pars Palpebralis
8	Lips toward each other	Orbicularis Oris
9	Nose wrinkler	Levator Labii superioris, alaeque nasi
10	Upper lip raiser	Levator Labii superioris, caput infraorbitalis
11	Nasolabial furrow deepener	Zygomatic Minor
13	Cheek puffer	Caninus
14	Dimpler	Buccinator
15	Lip corner depressor	Triangularis
16	Lower lip depressor	Depressor Labii Inferioris
17	Chin boss raiser	Mentalis
18	Lip puckerer	Incisivii Labii Superioris; Incisivus Labii Inferioris
20	Lip stretcher	Risorius
22	Lip funneler	Orbicularis Oris
23	Lip tightener	Orbicularis Oris
24	Lip pressor	Orbicularis Oris
25	Lips part	Depressor Labii, or relaxation of Mentalis or Orbicularis Oris
26	Jaw drops	Masseter; Temporal and Internal Pterygoid Relaxed
27	Mouth stretches	Pterygoids; Digastric
28	Lip suck	Orbicularis Oris
38	Nostril dialtor	Nasalis, pars alaris
39	Nostril compressor	Nasalis, pars transversa and Depressor Septi alae nasi
41	Lids droop	Relaxation of Levator palpebrae Seperioris
42	Eyes slit	Orbicularis Oculi
43	Eyes close	Relaxation of Levator palpebrae Seperioris
44	Squint	Orbicularis Oculi, pars palpebralis
45	Blink	Relaxation of Levator Palpebrae and Contraction of Orbicularis Oculi, pars palpebralis
46	Wink	Orbicularis Oculi

conversation AU 1 + 2 often accompanies positive anticipation of a forthcoming event, whereas AU 4 often accompanies optimism about the forthcoming event.

Rinn (1984) reviewed the neurophysiology of facial action and noted that the upper and lower facial motor neuron controls voluntary versus involuntary facial expressions, respectively. The face moves in many contexts, with many meanings, and many purposes, many of which are unrelated to emotional expression. How then was the FACS to be used in the study of emotion? Despite its breakthrough nature, there were two problems with FACS. First, it was a labor-intensive

process to code a face in motion, and with video tapes of any length, it was largely prohibitive. Second, it was difficult to interpret these many specific facial actions in terms of emotion. An additional step was needed that "translated" these small AUs into configurations of expressions that might be indicative of emotional expressions. To create this emotion "facial dictionary," Ekman and Friesen designed the Emotion Facial Affect Coding Sysem (EMFACS), and it was also planned to be a practical (more rapid) coding system. EMFACS requires three passes to code an emotion face, one examining the brow, the other the eyes and middle portion of the face, and the other examining the mouth. However, this system could be done with video tape in three times real time. Basic research on the role of facial expressions in emotion in marital interaction could now proceed. It is approximately 20 years after the publication of the FACS that we report these results.

We noted that this idea of studying faces during social interaction is also new to the study of emotion. Faces have primarily been studied using posed expressions or emotion-eliciting situations (e.g., films, startle stimuli). The idea of studying two faces who are also gazing at one other (or not gazing at one another) and simultaneously talking seems like another of Taguiri and Bruner's researcher's nightmares.

In this article we ask whether facial expressions of emotion are useful in understanding marital processes and outcomes. We use the context of our standard paradigm for studying marriages, in which we simultaneously collect synchronized video and physiological data from interacting couples, and then follow the couples longitudinally to examine marital outcomes.

One additional question we ask is whether Ekman's conjecture that "felt smiles" or Duchenne smiles (12 + 6) are different from smiles that have no orbicularis oculi involvement (12 without 6), which Ekman called "unfelt" smiles.

To summarize, in theorizing on marriage systems theorists called attention to ongoing patterns of interaction. Research, however, showed that it was negative affect and not communication clarity that discriminated happy from unhappy couples. To further specify what precisely *negativity* in marital interaction might mean, this article presents the first application of facial coding to ongoing marital interaction.

METHOD

Participants

Couples were recruited in 1983 in Bloomington, IN using newspaper advertisements. Approximately 200 couples who responded to these advertisements were administered a demographic questionnaire and two measures of marital satisfaction

(Burgess, Locke, & Thomes, 1971; Locke & Wallace, 1959) for which they were paid $5. From this sample, a smaller group of 85 couples was invited to participate in the laboratory assessments and to complete a number of additional questionnaires (including measures of health). The goal of this two-stage sampling was to obtain a distribution of marital satisfaction in which all parts of the distribution would be equally represented. Due to equipment problems, physiological data from six couples were incomplete, leaving a sample of 79 couples, who in 1983 had the following mean characteristics: (a) Husband age = 31.8 (*SD* = 9.5), (b) Wife age = 29.0 (*SD* = 6.8), (c) Years married = 5.2 (*SD* = 6.3), (d) Husband marital satisfaction (average of two marital satisfaction scales) = 96.80 (*SD* = 22.16), and (e) Wife marital satisfaction = 98.56 (*SD* = 20.70).

Procedure

Oral History Interview

The oral history interview asks the couple about their dating and marital history, their philosophy of marriage, and how their marriage has changed over time. It is a semi-structured interview conducted in the couple's home, in which the interviewer asks a set of open-ended questions about the history of the couple's relationship, how they met, how they courted and decided to get married, about the good times and the bad times in their marriage, how their marriage is similar or different from their parents' marriages, their philosophy of what makes a marriage work, their views of marital conflict, and how their marriage has changed over the years.

Interaction Session

The procedures employed in this experiment were modeled after those described in Levenson and Gottman (1983). Couples came to the laboratory after having not spoken for at least 8 hr. After recording devices for obtaining physiological measures were attached, couples engaged in three conversational interactions: (a) discussing the events of the day, (b) discussing the major problem area of continuing disagreement in their marriage, and (c) discussing a mutually agreed upon pleasant topic. Each conversation lasted for 15 min, preceded by a 5-min silent period. During the silent periods and discussions, a broad sample of physiological measures was obtained and a video recording was made of the interaction. Prior to initiating the problem area discussion, couples completed the Couple's Problem Inventory (Gottman, Markman, & Notarius, 1977), in which they rated the perceived severity (on a scale ranging from 0 to 100) of a standard set of marital issues such as money, in-laws, and sex. The experimenter, a graduate

student in counseling psychology, then helped the couple select an issue, which both spouses rated as being of high severity, to use as the topic for the problem area discussion. The Couple's Problem Inventory also provided an index of each spouse's ratings of the severity and chronicity of problems in the relationship (α = .79, husbands; α = .75, wives).

Questionnaires

The Locke-Wallace and Locke-Willimason (Burgess et al., 1971) were given to each couple. In addition, the following questionnaires developed in our laboratory were administered to each couple: (a) Flooding, which assess the extent to which a person feels overwhelmed by their partner's way of raising complaints; (b) a belief that their marital problems are not solvable; (c) the extent to which the couple leads their lives "in parallel," not eating together very much, having separate friends, and so on; and (d) the perceived severity of their marital issues. Reliability and validity data for these scales were presented by Gottman (1994).

For purposes of this study, only data from the problem area discussion were used. This decision was based on our previous research, in which data from the problem area discussion were the best longitudinal predictors of change in marital satisfaction (Levenson & Gottman, 1985).

1987 Follow-Up

In 1987, 4 years after the initial assessment, the original participants were re-contacted and at least one spouse (70 husbands, 72 wives) from 73 of the original 79 couples (92.4%) agreed to participate in the follow-up. These 73 participants represented 69 couples in which both spouses participated, one couple in which only the husband participated, and three couples in which only the wife participated. Data from the nonparticipating partner in these four couples were treated as missing data.

Marital outcomes. For the follow-up, spouses completed the two marital satisfaction questionnaires, a measure of physical illness (the Cornell Medical Index), and several items relevant to other stages of the hypothesized cascade model (i.e., during the 4-year period had the spouses considered separation or divorce, had they actually separated or divorced, and the length of any separation).

Apparatus

Physiological. At Time 1 five physiological measures were obtained using a system consisting of two Lafayette Instruments six-channel polygraphs and a DEC LSI 11/73 microcomputer:

1. Cardiac interbeat interval (IBI): Beckman miniature electrodes with Redux paste were placed in a bipolar configuration on opposite sides of the participant's chest and the interval between R-waves of the electrocardiogram (EKG) was measured in msec; shorter IBIs indicate faster heart rate (HR), which is typically interpreted as indicating a state of higher cardiovascular arousal.
2. Skin conductance level: A constant voltage device passed a small voltage between Beckman regular electrodes attached to the palmar surface of the middle phalanges of the first and third fingers of the nondominant hand using an electrolyte of sodium chloride in Unibase; increasing skin conductance indexes greater autonomic (sympathetic) activation.
3. General somatic activity: An electromechanical transducer attached to a platform under the participant's chair generated an electrical signal proportional to the amount of body movement in any direction.
4. Pulse transmission time to the finger: A UFI photoplethysmograph was attached to the second finger of the nondominant hand. The interval was measured between the R-wave of the EKG and the upstroke of the finger pulse; shorter pulse transmission times are indicative of greater autonomic (sympathetic) activation.
5. Finger pulse amplitude (FPA): The trough-to-peak amplitude of the finger pulse was measured. Finger pulse amplitude measures the amount of blood in the periphery; reduced FPA often indicates greater vasoconstriction, which is associated with greater autonomic sympathetic) activation.

This set of physiological measures was selected to sample broadly from major organ systems (cardiac, vascular, electrodermal, somatic muscle) to allow for continuous measurement, to be as unobtrusive as possible, and to include measures utilized in our previous studies (Levenson & Gottman, 1983).

The computer was programmed to process the physiological data online and to compute second-by-second averages for each physiological measure for each spouse. Later, averages were determined for each measure for the entire 15-min interaction period and for the 5-min baseline pre-interaction period.

Nonphysiological . Two remotely controlled high-resolution video cameras that were partially concealed behind darkened glass were used to obtain frontal views of each spouse's face and upper torso. These images were combined into a single split-screen image using a video special effects generator and were recorded on a VHS video recorder. Two lavaliere microphones were used to record the spouses' conversations. The DEC computer enabled synchronization between video and physiological data by controlling the operation of a device that imposed the elapsed time on the video recording.

Observational Coding

Coding emotional expressions. The EMFACS was used to code facial expressions of couples during the conflict discussion. Reliability was computed by having an independent observer code 25% of the videotapes with EMFACS and computing one inter-observer confusion matrix for all codes (see Bakeman & Gottman). These data were summarized using a computer program designed by Levenson in cooperation with Ekman and Friesen. The Cohen's kappa for all EMFACS codes over all videotapes was .77.

Oral history narratives coding. The oral history interview was coded on the following four dimensions (Buehlman, Gottman, & Katz, 1992):

1. *Fondness/Admiration* (husband and wife) is a dimension that rates couples according to how much they seem to be in love or fond of each other. This includes any compliments, positive affect, and reminiscing about romantic or special times.
2. *Negativity Toward Spouse* (husband and wife) assesses the extent to which spouses are vague or general about what attracted them to their spouse, the extent to which they express disagreement during the interview, the display of negative affect toward one another during the interview, and the extent to which they are critical of their spouse during the interview.
3. *We-Ness versus Separateness* (husband and wife) codes how much a spouse identifies his or her self as part of a couple versus emphasizes his or her individuality or independence (this includes use of "we" and "us" vs. "I" and "me" in each person's language).
4. *Cognitive Room* is a measure of the extent to which people spontaneously recall details about salient periods in their marriage. We have found that it is strongly related to the amount of knowledge each person has about their partner's psychological world, and the extent to which they periodically update this knowledge.

Overall reliability for the oral history coding system was maintained at 75% agreement between coders. Intercorrelations for individual dimensions ranged between .77 and .89.

RESULTS

Insider Perceptions of the Marriage

Table 2 summarizes the correlations between the total number of each type of facial expression and the total number of AUs for husband and wife during the conflict discussion with dimensions of the couple's perception of the marriage.

TABLE 2
Correlations Between Facial Expressions and the Couple's Perception of the Marriage

Facial Expression	*H Flooding*	*W Flooding*	*H Can't Solve It*	*W Can't Solve It*	*H Paral*	*W Paral*	*H Prob*	*W Prob*
Husband								
Anger	.10	–.06	.27**	–.02	.23**	–.06	.14	.01
Contempt	.10	.32***	.16	.24**	.02	–.19	.06	.28**
Disgust	.01	.04	.09	.16	–.17	–.14	.02	.09
Fear	.01	.04	–.06	.18	–.08	–.05	–.12	.10
Sadness	–.04	–.01	.12	.05	.10	–.06	–.15	–.04
Felt Happiness	–.21*	–.24**	–.17	–.05	–.17	–.03	–.12	–.02
Unfelt Happiness	.05	.06	.28**	.03	.31***	–.11	.25**	.05
Total AUs	–.09	–.05	.13	.04	.08	–.12	–.03	.05
Wife								
Anger	.06	.03	–.06	.18	.26**	–.02	–.02	–.09
Contempt	–.01	.00	.02	.01	.08	.03	–.01	–.19
Disgust	–.03	.13	–.14	.21*	.08	.03	–.01	–.19
Fear	.01	.02	.18	.05	.27**	.03	.17	–.03
Sadness	.04	.16	.24**	–.13	.06	.06	–.01	.12
Felt Happiness	–.30***	–.26**	–.11	.02	–.16	–.04	–.13	–.23**
Unfelt Happiness	–.26**	–.17	–.06	–.02	.17	–.18	–.08	–.18
Total AUs	–.18	–.14	.00	.10	.24**	–.04	–.07	–.19

Note. H = husband; W = wife; Paral = parallel lives; Prob = perceived severity of marital problems; AUs = action units.
*$p < .10$. **$p < .05$. ***$p < .01$.

Feeling Flooded

The number of husband Duchenne smiles, or expressions of Felt Happiness, was significantly negatively related to the wife's Feeling Flooded and marginally related to the husband's Feeling Flooded; the number of wife Duchenne smiles was significantly negatively related to both the husband and the wife Feeling Flooded. The husband's Contempt facial expressions were postitively related to the wife's Feeling Flooded.

Belief That Problems Cannot Be Worked Out

The husband's Anger and Unfelt Happiness expressions and his wife's Sadness expressions were positively significantly related to his belief that problems cannot be worked out with his wife. The husband's Contempt facial expressions and, marginally, the wife's Disgust expressions were related to her belief that problems cannot be worked out with her husband. These correlations also provide evidence that Unfelt Smiles and Felt Smiles (Duchenne smiles) operate very differently. Recall that Unfelt Smiles have Zygomaticus (lip corner) but no Orbicularis Oculi (eye) involvement.

Parallel Lives

The wife's judgment that the couple does much less together now than they used to was significantly related to her husband's Anger facial expressions, his Unfelt Happiness expressions, her Anger expressions, her Fear expressions, and the total number of facial AUs. There were no significant correlations between facial expressions and the husband's judgment that the couple does much less together than they used to.

Problem Severity

The husband's perception of the severity of the couple's marital problems was positively related to his Unfelt Happiness expressions. The wife's perception of the severity of the couple's marital problems was positively related to his Contempt expressions and negatively related to her Felt Happiness expressions.

Marital Outcomes

Table 3 summarizes the correlation between facial expressions and marital outcomes.

TABLE 3
Correlations Between Facial Expressions and Marital Outcomes

	Months Reported Separated in Four Years		*Physical Illness*	
Facial Expression	*Husband*	*Wife*	*Husband*	*Wife*
Husband				
Anger	–.05	–.03	.15	.10
Contempt	–.14	–.14	.06	.34**
Disgust	–.10	–.09	–.01	.11
Fear	.26**	.17	.26**	.26**
Sadness	–.08	–.05	.07	–.06
Felt happiness	.05	–.03	–.05	.05
Unfelt happiness	.41***	.41***	–.03	.28**
Total AUs	.15	.11	.14	.19
Wife				
Anger	.21*	.19	.04	.03
Contempt	.14	.11	.03	–.02
Disgust	.51†	.49†	–.08	.05
Fear	–.04	.00	–.02	.03
Sadness	–.09	–.05	–.14	–.09
Felt happiness	.10	.04	.05	–.02
Unfelt happiness	.33***	.25	–.03	–.05
Total AUs	.18	.14	–.01	–.07

Note. AUs = action units.
*$p < .10$. **$p < .05$. ***$p < .01$. †$p < .001$.

Marital Separation

The number of months the husband reported that the couple separated in the 4 years of the assessment was predicted significantly by his Time 1 Fear expressions and his Unfelt Happiness expressions, to his wife's Disgust expressions, and to his wife's Unfelt Happiness expressions. The number of months the wife reported that the couple separated in the 4 years of the assessment was predicted significantly by the husband's Unfelt Happiness expressions and by her Disgust expressions.

Self-Reported Physical Illness

The wife's physical illness in the 4 years of the assessment was predicted by the husband's Time 1 Contempt facial expressions, Fear expressions, and Unfelt Happiness expressions. The husband's illness in the 4 years of the assessment was predicted by the husband's Time 1 Fear expressions.

Physiology During Interaction

Table 4 summarizes the correlations between facial expressions during conflict and IBI (time between successive R-spikes of the electrocardiogram) and Pulse Transit Time (PTT; a measure of the time it takes blood to arrive at the finger of the nondominant hand after an R-wave of the electrocardiogram) variables during conflict. Recall that HR and IBI are related inversely (HR = 60000/IBI). The facial variables were unrelated to the other physiological variables.

HR. The husband's Fear, Sadness, and the total number of his facial AUs were associated with his higher HR, whereas for the wife's HR, her husband's Felt Happiness expressions (and marginally hers) were associated with her lowered HR.

PTT. The husband's PTT was shorter (faster blood velocity) if he expressed more contempt, more fear, and had more facial AUs. The wife's PTT was marginally longer (slower blood velocity) if she expressed more Felt Happiness.

TABLE 4
Correlations Between Facial Expressions and Physiology During Conflict Interaction

	Mean Interbeat Interval		*Mean Pulse Transit Time*	
Facial Expression	*Husband*	*Wife*	*Husband*	*Wife*
Husband				
Anger	–.07	–.06	–.06	–.20
Contempt	–.04	–.08	–.23**	.03
Disgust	–.11	.06	–.17	.01
Fear	–.24**	.02	–.24**	.04
Sadness	–.30***	–.07	–.13	.04
Felt happiness	–.07	.24**	–.20*	.18
Unfelt happiness	–.11	.01	–.06	–.15
Total AUs	–.24**	.10	–.27**	–.02
Wife				
Anger	–.03	–.15	–.07	–.10
Contempt	.14	.04	–.09	–.01
Disgust	.09	.05	.08	–.14
Fear	–.06	–.07	.06	.18
Sadness	–.11	–.11	.12	.16
Felt happiness	–.06	.22*	–.03	.19*
Unfelt happiness	–.11	.18	–.10	.04
Total AUs	–.04	.06	.03	.08

Note. AUs = action units.
*$p < .10$. **$p < .05$. ***$p < .01$.

Interacts

Table 5 summarizes the correlation of the number of interacts with facial expressions. The number of interacts assesses the extent to which the conversation showed a back-and-forth dialogue versus long monologues by one or both partners.

The number of interacts was significantly related to more husband Disgust and Felt and Unfelt Happiness, more husband facial AUs, more wife Felt and Unfelt Happiness, and more wife facial AUs.

Oral History Variables

Table 6 summarizes the relations between the oral history codes and the facial expression data.

Fondness and admiration. The husband's Sadness facial expressions during the conflict discussion were negatively related to his fondness for her and her fondness for him during the Oral History Interview. His Unfelt Happiness expres-

TABLE 5
Correlations Between Facial Expressions and the Number of Interacts

Facial Expressions	*Number of Interacts*
Husband	
Anger	.13
Contempt	–.12
Disgust	.32*
Fear	.12
Sadness	.02
Felt happiness	.46**
Unfelt happiness	.30*
Total AUs	.39**
Wife	
Anger	.15
Contempt	.15
Disgust	.10
Fear	.07
Sadness	.01
Felt happiness	.50**
Unfelt appiness	.47**
Total AUs	.37**

Note. AUs = action units.
*$p < .01$. **$p < .001$.

TABLE 6
Correlations of Facial Expressions With Oral History Variables

Facial Expressions	*H Fondeness*	*W Fondness*	*H Negativity*	*W Negativity*	*H We-Ness*	*W We-Ness*	*Cognitive Room* *H*	*Cognitive Room* *W*
Husband								
Anger	.15	.05	.03	.06	–.10	–.06	.11	.16
Contempt	–.09	.01	.09	.00	.05	.07	–.02	.01
Disgust	.01	.14	.04	–.07	.20	.19	.04	.13
Fear	–.21	–.23	.40†	.22*	–.04	–.19	.03	–.07
Sadness	–.30**	–.32**	.33***	.28**	–.26**	–.40†	–.09	–.13
Felt happiness	.00	.08	–.01	–.02	.04	.00	–.08	.12
Unfelt happiness	.06	.23*	–.08	–.16	.02	.03	.02	.18
Total AUs	–.01	.05	.14	.01	.07	.03	.08	.21*
Wife								
Anger	.01	–.12	.06	.14	–.16	–.18	–.05	–.20
Contempt	.12	.14	–.13	–.06	–.02	.06	–.03	.04
Disgust	.01	.09	–.13	–.23*	.18	.26**	–.09	–.07
Fear	–.09	.00	.12	–.03	.00	–.07	–.06	–.12
Sadness	–.05	–.06	.02	.06	–.11	–.11	–.10	–.15
Felt Happiness	.04	.19	–.01	–.09	–.02	.04	–.10	.09
Unfelt Happiness	–.07	.02	.11	.01	–.11	–.14	–.09	–.05
Total AUs	–.09	–.01	.11	–.02	–.10	–.11	–.21*	–.19

Note. H = husband; W = wife; AUs = action units.
*p <.10. **p <.05. ***p< .01. †p < .001.

sions during conflict were marginally positively related to the wife's fondness for him during the Oral History Interview.

Negativity. The husband's negativity toward his wife during the Oral History Interview was positively related to his Fear and Sadness expressions. The wife's negativity toward her husband during the Oral History Interview was marginally positively related to his Fear, significantly positively related to his Sadness expressions, and marginally negatively related to her Disgust expressions.

We-Ness. The husband's and the wife's we-ness was negatively related to his Sadness facial expressions. The wife's we-ness was positively related to her Disgust facial expressions.

Cognitive room. Cognitive room for the relationship was unrelated to facial expressions. There was a marginally significant positive association between the wife's cognitive room and the total number of husband AUs and a marginally significant negative association between the husband's cognitive room and the total number of wife AUs.

DISCUSSION

This article provides the first demonstration that coding of facial action during marital conversation has concurrent and predictive validity. Facial expressions were related in interpretable ways with the couple's perception of the relationship, with significant marital and health outcomes, with concurrent physiological responses, with the number of interacts, and with the couple's behavior during our Oral History Interview. The Oral History Interview coding has been found in two previous studies to be predictive of marital stability or divorce (Buehlman et al., 1992; Carrère, Woodin, Coan, & Gottman, 2000).

Duchenne smiles, or expressions of Felt Happiness for both spouses, were significantly negatively related to the wife's Feeling Flooded, whereas the husband's Contempt facial expressions were positively related to the wife's Feeling Flooded. The husband's Anger and Unfelt Happiness expressions and his wife's Sadness expressions were related to his belief that problems cannot be worked out with his wife. The husband's Contempt facial expressions were related to her belief that problems cannot be worked out with her husband. The wife's judgment that the couple does much less together than they used to was significantly related to her husband's Anger facial expressions, his Unfelt Happiness expressions, her Anger expressions, her Fear expressions, and the total number of facial AUs. The husband's perception of the severity of the couple's marital problems was related to his Unfelt Happiness expressions. The wife's perception of the severity of the

couple's marital problems was related to his Contempt expressions and negatively related to her Felt Happiness expressions.

Facial expression predicted significant marital outcomes. The number of months the husband reported that the couple separated in the 4 years of the assessment was predicted significantly by his Fear expressions and his Unfelt Happiness expressions, by his wife's Disgust expressions and by his wife's Unfelt Happiness expressions. The number of months the wife reported that the couple separated in the 4 years of the assessment was predicted significantly by the husband's Unfelt Happiness expressions and by her Disgust expressions. The wife's illness in the 4 years of the assessment was predicted by the husband's Contempt facial expressions, the husband's Fear expressions, and by the husband's Unfelt Happiness expressions. The husband's illness in the 4 years of the assessment was predicted by the husband's Fear expressions.

Facial expressions during marital conflict were related to some measures of the couple's physiology during the interaction. The husband's Fear, Sadness, and the total number of his facial AUs were associated with his higher HR, whereas for the wife's HR, her husband's Felt Happiness expressions (and marginally hers) were associated with her lowered HR. The husband's PTT was shorter (faster blood velocity) if he expressed more contempt, more fear, and had more facial AUs. The wife's PTT was marginally longer (slower blood velocity) if she expressed more Felt Happiness.

The number of interacts, which assess the extent to which the conversation showed a back-and-forth dialogue versus long monologues by one or both partners, were related to more facial AUs by both spouses, and to Disgust and Felt and Unfelt Happiness expressions of the husband and to Felt and Unfelt Happiness expressions of the wife.

The data also permitted us to ask the question whether Ekman's speculation that felt and unfelt smiles really function differently. The data in Table 2 show that the husband's unfelt smiles are related to negative perceptions of the marriage (the husband's belief that their marital problems are not solvable, the husband's report that the couple leads parallel lives, and his rating that their problems are severe). His Felt Happiness expressions were related to his wife being *less* flooded. The wife's Felt Happiness expressions were related negatively to a poor perception of the marriage (husband flooding, wife flooding, and wife problem severity ratings); her unfelt happy expressions, however, were also related negatively to her husband's flooding. Only the husband's and wife's Unfelt Happiness facial expressions predicted negative marital and health outcomes. There was no evidence that the two facial expressions differed in the physiological variables studied in this article, and both the amount of facial expression and Felt and Unfelt Happiness scores were significantly correlated with the number of interacts. Neither facial expression was related to the Oral History variables. In summary, these data offer support for Ekman's contention.

The current data may have more implications for assessment of marriages than for marital therapy. Following this basic research on facial expressions, these data suggest that if therapists were sensitive to facial expressions, they would be aware of important dimensions of the marriage on an ongoing and changing basis, and would also have tapped into important predictors of marital outcomes. Facial expressions that have been shown to be important in this study are Anger, Disgust, Contempt, Sadness, and Fear, and the distinction between Unfelt Happiness and Duchenne smiles.

An affectively based marital therapy was developed and tested by Greenberg and Johnson (1988). This therapy was based on attachment theory, and suggested that behind the "harder" negative affects characterized by anger and hostility, there were "softer" affects of insecurity, loss, and sadness. By exploring these softer emotions the therapist could facilitate empathy in the partner who had been the target of the harder affects. Generating this empathy was the goal of the therapy. However, this study does not suggest that the softer negative affects are more important than the harder affects in assessing a marriage. This raises some doubt about the validity of Greenberg and Johnson's distinction, at least in the facial measurement domain.

We are a long way from creating the new relationship science Berscheid (1999) called for. However, we suspect that its creation will require a confluence of research on emotion and communication, and this research needs to begin with the basics of understanding how emotional expressions unfold over time in the context of real relationships. In is in that spirit that we offer this investigation.

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