

## The Influence of Age and Gender on Affect, Physiology, and Their Interrelations: A Study of Long-Term Marriages

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Self-reported affect and autonomic and somatic physiology were studied during three 15-min conversations (events of the day, problem area, pleasant topic) in a sample of 151 couples in long-term marriages. Couples differed in age (40–50 or 60–70) and marital satisfaction (satisfied or dissatisfied). Marital interaction in older couples was associated with more affective positivity and lower physiological arousal (even when controlling for affective differences) than in middle-age couples. As has previously been found with younger couples, marital dissatisfaction was associated with less positive affect, greater negative affect, and greater negative affect reciprocity. In terms of the relation between physiological arousal and affective experience, husbands reported feeling more negative the more they were physiologically aroused; for wives, affect and arousal were not correlated. These findings are related to theories of socioemotional change with age and of gender differences in marital behavior and health.

In the experiment described in this article, we applied observational methods to study affect and physiology in the interactions in a sample of middle-aged and older couples who have been married for most of their adult lives. This article focuses on four issues: (a) age-related differences in the affective quality of marital interaction; (b) age-related differences in the physiological activation produced by marital interaction; (c) continuity in later life of affective markers of marital distress; and (d) gender differences in the covariation between subjective emotional experience and physiological activation. We begin by briefly reviewing the literatures relevant to each issue.

### *Affective Quality of Marriage in Late Life*

Most research on marriage has studied relatively young couples in the early stages of marriage. Much less is known about the nature of long-term marriages in later life.

### *Marital Satisfaction*

Early cross-sectional studies of marriage indicated that marital satisfaction steadily declined over time (Blood & Wolfe,

1960; Dentler & Pineo, 1960; Pineo, 1961, 1969). Subsequent studies that more fully sampled marriages across the entire life span revealed a much less monotonic and much more complex pattern, with marital satisfaction reaching low points after the birth of the first child and when children are adolescents, and reaching high points at the beginning of marriage and when children leave home (Anderson, Russell, & Schumm, 1983; Burr, 1970; Cowan & Pape-Cowan, 1988; Doherty & Jacobson, 1982; Rollins & Cannon, 1974; Thurnher, 1976). According to popular lore, retirement is thought to have a major impact on marital quality. Although some data suggest that retirement improves marital quality (e.g., Atchley, 1976; Dorfman & Heckert, 1988; Gilford, 1984), a number of studies have found it to have little effect (e.g., Ekerdt & Vinick, 1991; Matthews & Brown, 1987; Vinick & Ekerdt, 1991) or slightly negative effects (e.g., Lee & Shehan, 1989). In the present study, to avoid possible confounds, we limited the sample to couples who had not yet retired.

### *Affective Characteristics*

On the basis of questionnaire and interview data, older couples have been described as largely happy, affectionate, and emotionally close (e.g., Erikson, Erikson, & Kivnick, 1986; Paron, 1982; Stinnett, Carter, & Montgomery, 1972). Guilford and Bengtson's (1979) multigenerational study of families indicated that positive interaction followed a path somewhat like that of marital satisfaction (i.e., highest in the youngest couples, lowest in the middle-aged couples, and intermediate in the older couples); an orthogonal quality, negative sentiment, decreased linearly with age. Thus, in their older couples, positive interaction would be moderately high and negative sentiment would be

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very low. In questionnaire data obtained from the subjects in the present study, we found that, compared with couples in middle-aged marriages, couples in older marriages reported less severity of a number of potential sources of conflict and greater pleasure associated with a wide range of activities (Levenson, Carstensen, & Gottman, 1993).

Findings of relatively positive affective qualities in late-life marriages predominate in these literatures, but they are not entirely uncontested, with some researchers documenting effects of age-related stressors, such as poor health, on marital tone (e.g., Atchley & Miller, 1983; Lowenthal, Thurnher, & Chiriboga, 1975; Peterson, 1973; Zietlow & Sillars, 1988). Furthermore, our confidence in the relatively glowing descriptions of marriage in late life is lessened by a general failure to assess and control for possible differences in marital satisfaction between age groups; if older couples are more satisfied than younger couples, this could certainly contribute to findings of age-related differences in affective experience.

### *Summary and Theoretical Rationale*

On balance, our reading of the literatures on marital satisfaction and affective marital characteristics suggests that the emotional quality of late-life marriages is relatively positive. This conclusion conforms to the predictions derived from socioemotional selectivity theory (Carstensen, 1987, 1991, 1993). According to this theory, beginning in early adulthood and continuing through old age, people actively narrow their social environment and achieve increasing emotional closeness in and attribute increasing importance to significant relationships (Carstensen, 1992, 1993). At the same time, as people age, the hedonic qualities of social relationships become increasingly salient. Socioemotional selectivity theory is consistent with Baltes and Baltes's (1990) more general model of selective optimization with compensation, in which adaptive aging entails maximizing positive experience within an increasingly narrow band of activity.

### *Age-Related Changes in Emotional Physiology*

The autonomic nervous system is clearly affected by age. Experimental and clinical studies show that aging is associated with a decrease in sympathetic and parasympathetic innervation (Frolkis, 1977). However, the nature of age-related changes in autonomic reactivity is more equivocal (Eisdorfer, 1978). For example, most studies of end-organ responses (e.g., heart rate change) show diminished reactivity with age. Illustrative findings include older people showing (a) reduced reactivity to cardiovascular conditioning using shock (Shmavonian, Miller, & Cohen, 1970), (b) reduced galvanic skin response and more rapid extinction during shock conditioning (Botwinick & Kornetsky, 1960), and (c) less heart rate reactivity to a mental arithmetic stressor (Fürchtgott & Busemeyer, 1979).

Studies of neurohumoral reactivity, in contrast, often find enhanced reactivity with age. For example, smaller doses of catecholamines, acetylcholine, and serotonin are needed to produce equivalent hemodynamic effects in older subjects than in younger subjects (Bogatskaya, 1972). Older subjects show greater

norepinephrine and blood pressure responsiveness to cold pressor tasks and isometric exercise than do younger subjects (Palmer, Ziegler, & Lake, 1978).

The significance of these age-related changes for emotional functioning is unclear, given that studies of autonomic activity using emotional stimuli are rare in the experimental literature on aging. There are, however, reports that, during serial learning, the electrodermal response to emotionally charged words is greater in old subjects than in young subjects (Shmavonian & Busse, 1963; Wilkie & Eisdorfer, 1977). Consistent with these findings, Schulz (1985) has speculated that emotions may be more intense and long lasting in old age, reflecting a decrease in the efficiency of homeostatic mechanisms that act to restore equilibrium following autonomic activation.

A previous experiment by our research group is the only study we are aware of that has directly studied autonomic reactivity during specific emotions in older adults (Levenson, Carstensen, Friesen, & Ekman, 1991). Levenson et al. elicited emotions (e.g., anger, disgust, fear, happiness, sadness) in young and old subjects by having them relive emotional memories and by having them produce emotional facial configurations. They found that patterns of emotion-specific autonomic activity were the same in the two age groups, but that the magnitude of the attendant autonomic changes was smaller in the older subjects.

### *Affective Qualities of Dissatisfied Marriages*

Systematic observational research on marital interaction began in the 1970s (e.g., Rausch, Barry, Hertel, & Swain, 1974; Weiss, Hops, & Patterson, 1973) and has been quite prevalent in the ensuing decades (e.g., Gottman & Levenson, 1992; Levenson & Gottman, 1983; Revenstorf, Vogel, Wegener, Halweg, & Schindler, 1980). Among the most consistent findings in this literature is the association of marital dissatisfaction with low levels of positive affect, high levels of negative affect, and high levels of negative affect reciprocity (e.g., Cousins & Vincent, 1983; Gottman, 1979, 1980; Levenson & Gottman, 1983; Rausch et al., 1974; Revenstorf et al., 1980; Schaap, 1982; Ting-Toomey, 1983; Wills, Weiss, & Patterson, 1974).

The focus of these observational studies has been primarily on relatively young couples, thus there is a need to determine whether these affective qualities continue to typify distressed marriages in later life. In fact, to our knowledge, there has been only one published observational study of marital interaction in old age. Zietlow and Sillars (1988) studied age differences in the affective quality of marital discussions in a sample of 59 couples recruited from a Milwaukee church. However, they did not control for marital satisfaction. Thus, it is unclear how their findings (e.g., retired couples are more likely to reciprocate confrontational statements than are young or middle-aged couples) relate to the observational literature on marital satisfaction.

### *Gender Differences in the Relation Between Affect and Physiology*

#### *Theory of Gender Differences in Marital Behavior*

Starting in the 1930s (Terman, Bottenweiser, Ferguson, Johnson, & Wilson, 1938), there have been consistent findings of re-

liable differences in the way that wives and husbands deal with conflict (e.g., Christensen, 1988; Christensen & Heavey, 1990; Gottman & Levenson, 1993). Wives push toward resolution of conflicts, apparently undaunted by emotional arousal, whereas husbands attempt to end conflictive discussions quickly, either by attempts toward reconciliation (when conflict levels are low) or by blatant withdrawal (when conflict levels are high).

These findings led Gottman and Levenson (1988) to propose a social psychophysiological theory of gender differences in marital behavior. In this model, marital conflict is viewed as producing high levels of negative affect, especially in unhappy marriages. High levels of negative emotions, such as anger, fear, and sadness, result in high levels of autonomic arousal (e.g., Levenson et al., 1991; Levenson, Ekman, & Friesen, 1990). Men and women have different reactions to this heightened arousal. Women have considerable tolerance for physiological arousal and, thus, can maintain high levels of engagement. Men, in contrast, experience this arousal as being highly aversive and act to dissipate it by withdrawing from the conflict.

Implicit in this model are notions concerning gender differences in the relations among physiology, awareness of physiology, and affect. For high levels of physiological arousal to be experienced as aversive and to motivate male withdrawal behavior, men would need either to be closely attuned to changes in their level of arousal or to feel badly when aroused, or both. To be able to tolerate these high levels of arousal women would need either to not be attuned to changes in their level of arousal or to not feel badly when aroused, or both.<sup>1</sup>

### *Visceral Perception*

As regards attunement to physiology, there is empirical support for the notion that men are closely attuned to changes in their bodily states and that women are not. In studies of visceral perception, men are better able to track changes in their heart rate than women (e.g., Katkin, Blascovich, & Goldband, 1981). In the most carefully controlled of these studies, Harver, Katkin, and Bloch (1993) found that men were more accurate than women in perceiving visceral activity in two different autonomic systems (cardiovascular and respiratory); importantly, there were no gender differences in a nonphysiological perceptual task. These findings are not limited to studies of visceral perception. In a study of the relation between perceived effort and cardiovascular change in competitive swimmers, Koltyn, O'Connor, and Morgan (1991) found a closer relation for men than for women. Pennebaker and Roberts (1992) offered a generalized model of such gender differences, arguing that men attend more to internal states in determining their affective states, whereas women are more likely to consider external, situational factors.

### *Feelings and Arousal*

In the present study, we did not directly test gender differences in visceral perception. We did, however, test another aspect of the model—whether the sexes are different in the relation between the way they feel and their level of physiological arousal. We predicted that husbands' reports of negative feel-

ings would be related to their levels of physiological arousal, feeling badly when aroused; in contrast, wives' reports of feelings would not be related to their levels of physiological arousal.

### *The Present Study*

In the present study, we applied Levenson and Gottman's (1983) observational paradigm for studying marital interaction to a sample of 156 long-term marriages that differed in terms of age (older, 60–70 years; middle-age, 40–50 years) and marital satisfaction (happy and unhappy). In this paradigm, couples are studied during unrehearsed, minimally structured conversations that typically occur in the home (talking about the day's events, trying to resolve a conflict, discussing something enjoyable). The conversations are videotaped and a broad range of physiological measures are obtained continuously from both spouses. Subsequently, spouses view video recordings of their interactions and provide continuous self-ratings of their affect during the interactions.

Some mention should be made of why we chose to study long-term marriages and why we picked these particular age groups. In previous marital research conducted by members of our group, the average age of spouses was 27 years in one sample (Levenson & Gottman, 1983) and 30 years in another (Gottman & Levenson, 1992). Consequently, the marriages were not of particularly long duration. For the present research, we wanted to study long-term marriages in which couples had been together for most of their adult lives. These are marriages that have endured despite the cumulative effects of the stresses and challenges that accrue over time. We selected an older cohort between the ages of 60 and 70 because they are on the threshold of old age and thus afford us an opportunity to follow them longitudinally as they pass through the unique changes of late life. Given our interest in gender, the present cohort in this age range is also of considerable interest because of the dramatic social changes they have lived through, many of which—such as the women's movement, the entry of greater numbers of women into the workforce, and the "sexual revolution"—had profound implications for relationships between women and men. We chose the middle-aged comparison cohort—couples between the ages of 40 and 50—to represent the generation of our older cohort's children and to preserve the possibility of following them over the next 20 years until they reach the current age of our older cohort.

Whereas most prior observational studies of marriage have used convenience samples, we constructed the sample in this study to be representative of both satisfied and unsatisfied long-term marriages in these two age groups in the east San Francisco Bay area.

### *Hypotheses*

On the basis of the research reviewed above and our theoretical models of socioemotional selectivity (Carstensen, 1987,

<sup>1</sup> A less parsimonious explanation is that women do in fact experience these states as aversive, but act in a "masochistic" fashion, not engaging in behaviors that minimize pain and maximize pleasure. We consider this explanation highly unlikely.

1991, 1993) and gender differences in marriage (Gottman & Levenson, 1988), we formulated three hypotheses: (a) There will be greater emotional positivity in the interactions of older couples than middle-aged couples, even after controlling for possible differences in marital satisfaction; (b) there will be less physiological activation during marital interaction in older couples than in middle-aged couples; and (c) there will be significant positive correlations between negative affect and physiological arousal for men, but not for women.

Having neither empirical nor theoretical basis for prediction, we offered no a priori hypothesis about whether dissatisfied late-life marriages would be typified by the same affective patterns (i.e., decreased positive affect, increased negative affect, increased negative affect reciprocity) as had been found previously for dissatisfied younger marriages.

### Method

#### Subjects

To recruit a sample of old and middle-aged couples who were representative of the ethnic, economic, and religious makeup of the Berkeley, California, area, we constructed the experimental sample in three stages. First, we employed a survey research company to conduct a random telephone survey that broadly assessed the population characteristics of married couples living in the east San Francisco Bay area. Second, we screened prospective subjects by having them complete a questionnaire packet. Third, from this pool of prospective subjects, we recruited couples who met selection criteria that were established on the basis of the random survey.

*Random telephone survey.* Randomly drawing names from lists of all licensed drivers and registered voters in the east Bay area, a survey research company (Illini Research Center) made calls until they had completed telephone interviews with 170 women who were (a) married and currently living with their husbands, (b) either between the ages of 40 and 50 and married at least 15 years or between the ages of 60 and 70 and married at least 35 years, and (c) in marriages in which the major wage earner had not retired. These criteria enabled us to target couples who differed by approximately 20 years both in age and in duration of marriage and who would have been married for most of their adult lives.

The telephone interview consisted of oral administration of a measure of marital satisfaction (Locke & Wallace, 1959) and demographic questions relevant to ethnicity, religion, spouses' education, parents' education, and spouses' occupations. Wives, as opposed to husbands, were interviewed during this screening because (a) we have found them to be generally more willing to talk to researchers about their marriages than are husbands, and (b) the Locke-Wallace scores obtained by telephone from wives are highly correlated with their own and their husbands' scores on the paper-and-pencil version of the test (Gottman & Krokoff, 1989).

We used data obtained from this telephone survey to establish selection criteria for the actual experimental sample in terms of marital satisfaction, ethnicity, religion, and socioeconomic status (e.g., a certain number of dissatisfied, White, Protestant, white-collar couples in each age group).

*Recruitment and initial screening.* Subjects were recruited using newspaper advertisements and articles, announcements on radio stations, notices in employee newsletters and church bulletins, fliers posted on bulletin boards, and advertising placards on city buses. Interested couples were asked to contact the laboratory by telephone.

Brief telephone screenings were conducted with 960 respondents to determine whether they met our criteria for age, duration of marriage,

geographical location, and retirement status. Qualified couples were told about the experimental procedure and, if still interested, were mailed a questionnaire package that included measures of (a) demographic information, education, and marital history; (b) alcohol consumption and alcoholism; and (c) psychological, physical, and functional health. Also included were two well-established measures of marital satisfaction—the Locke-Williamson (Burgess, Locke, & Thomes, 1971) and the Locke-Wallace (Locke & Wallace, 1959)—which we have used in all of our previous studies of marriage. The Locke-Williamson is a 22-item inventory (e.g., "Do you and your mate agree on handling family finances?"). The Locke-Wallace is a 15-item inventory (e.g., "Do you confide in your mate?"). Each spouse was asked to complete the questionnaires separately without consulting with the other spouse. Couples were paid \$20 for filling out this screening questionnaire, which was completed by 297 couples.

*Selection of experimental sample.* We recruited couples into one of four experimental groups based on criteria for age and marital satisfaction: (a) middle-aged satisfied, (b) middle-aged dissatisfied, (c) old satisfied, and (d) old dissatisfied. Criteria for age and duration of marriage were the same as those used in the random telephone survey (old couples—oldest spouse between the ages of 60 and 70, married for at least 35 years; middle-aged couples—oldest spouse between the ages of 40 and 50, married for at least 15 years). During recruitment, initial assignments to the satisfied and dissatisfied groups were based on the wives' marital satisfaction score using the cutoffs derived from the random telephone survey (i.e., mean score for each age group). For middle-aged couples, the wife's marital satisfaction score had to be greater than 124 for the satisfied group and less than or equal to 124 for the dissatisfied group; for old couples, the cutoff was 127. To ensure comparability of marital satisfaction across age subgroups, final assignments to experimental groups were based on a single cutoff for all couples.

Couples for all experimental groups had to meet the following additional criteria: (a) marital satisfaction scores within 20 points of each other, (b) age difference between spouses of no more than 5 years, (c) primary wage earner not retired, (d) living within a 10-mile radius of the University of California, Berkeley, (e) neither spouse alcoholic (as indicated by scoring seven or lower on the Michigan Alcoholism Screening Test; Selzer, 1971), and (f) English as the native language, or the language customarily spoken at home. Our rationale for these additional satisfaction and age criteria was to make our sample representative of the modal long-term marriage, in which couples are relatively close in marital satisfaction and age, and to avoid having individual spouses fall into different satisfaction or age groups.

Within each group, we attempted to recruit couples with the widest possible distribution of marital satisfaction scores. We also attempted to have the composition of each group match the demographic criteria established in the random telephone survey for socioeconomic status, religion, and ethnicity. For socioeconomic status, we used the U.S. Bureau of the Census's (1982) classified index of industries and occupations to classify each couple as being either blue collar (service, farming, forestry, fishing, precision production, craft, repair, operators, fabricators, laborers), pink collar (technical, sales, administrative support), or white collar (managerial, professional) on the basis of the major wage earner's job.

We were generally successful in meeting our recruitment goals for age, satisfaction, socioeconomic status, and religion, but were less successful for ethnicity. We encountered considerable difficulties finding minority couples for some of our experimental groups (especially old dissatisfied couples). Rather than having unequal ethnic distributions, we over-sampled (by 17%) White couples in all four groups.

*Final sample.* The final sample for the laboratory experiment consisted of 156 couples, 155 of which were in first marriages. Childless couples were quite rare and almost all couples had completed family

building—149 of the couples had children, and one middle-aged couple was in the midst of an unplanned pregnancy. The average age of children was 16.8 years ( $SD = 5.3$ , range = 7–28) for middle-aged couples and 35.8 years ( $SD = 3.89$ , range = 27–46) for older couples. Among middle-aged couples who had children, 88% still had children living at home; among older couples, 16% still had children living at home.

For middle-aged couples, the mean age was 44.3 ( $SD = 2.9$ ) for husbands and 43.3 ( $SD = 2.9$ ) for wives. For older couples, the mean age was 63.6 ( $SD = 2.9$ ) for husbands and 62.2 ( $SD = 3.2$ ) for wives.

As has been our practice in all of our previous marriage research, we computed an aggregated marital satisfaction score for each couple by averaging both spouses' scores on the Locke-Wallace and Locke-Williamson tests. For the entire sample, the mean was 111.5 ( $SD = 17.0$ ) and the median was 115.1 (range = 42.8–160.0), the latter being used to make the final assignments to experimental groups: (a) middle-aged satisfied ( $n = 35$ ), (b) middle-aged dissatisfied ( $n = 47$ ), (c) old satisfied ( $n = 43$ ), and (d) old dissatisfied ( $n = 31$ ).

*Demographic characteristics of the final sample.* The final sample can be characterized as White, upper middle class, white collar, well educated, and Judeo-Christian, reflecting the demographics of the Berkeley environs.

Sample specifics were (a) ethnicity—85.9% White, 5.8% African American, 2.6% Hispanic, 2.6% Asian, and 2.2% in which spouses were of different ethnicities; (b) household income—median = \$50,000–\$59,999; range = below \$10,000–above \$100,000; (c) job status of major wage earner—68.6% white collar, 19.9% pink collar, and 11.5% blue collar; (d) education—mean years = 16.0, range = 8–20; and (e) religion—39.7% Protestant, 14.1% Catholic, 13.5% Jewish, 8.3% other religion, 12.2% no religion, and 12.2% in which spouses were of different religions.

## Procedure

*Interaction session.* The procedures used in this experiment were modeled after those developed by Levenson and Gottman (1983). Couples came to the laboratory after having not spoken to each other for at least 8 hr. After recording devices for obtaining physiological measures were attached, couples engaged in three conversations: (a) discussing the events of the day; (b) discussing a 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.

For the events of the day conversation, subjects were simply told to discuss what had happened during the day. Before initiating the problem area discussion, couples completed the Couple's Problem Inventory (Gottman, Markman, & Notarius, 1977), in which they rated the perceived severity of 10 marital issues on a 0–100 scale. Before initiating the pleasant topic discussion, couples completed a similar inventory in which they rated the enjoyment they derived from 16 topics on a 0–100 scale. The experimenter used these inventories to help couples select the topics that were used in these two conversations.

*Recall session.* Several days later, spouses returned separately to the laboratory to view the video recording of their interaction while the same physiological measures were obtained and synchronized with those obtained in the interaction session. Spouses used a rating dial to provide a continuous self-report of affect. The dial traversed a 180° path, with the dial pointer moving over a 9-point scale anchored by the legends *extremely negative* and *extremely positive*, with *neutral* in the middle. Spouses were instructed to adjust the dial continuously so that it always represented how they had been feeling when they were in the interaction. Data supporting the validity of this procedure for obtaining

continuous self-reported affect ratings have been presented elsewhere (Gottman & Levenson, 1985).

## Apparatus

*Physiological.* We obtained seven physiological measures from each spouse using a system consisting of a Grass Model 7 12-channel polygraph and a DEC LSI 11/73 microcomputer: (a) cardiac interbeat interval (IBI)—Beckman miniature electrodes with Redux paste were placed in a bipolar configuration on opposite sides of the subject's chest and the interval between successive R-waves of the electrocardiogram (EKG) was measured in ms; (b) 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 sodium chloride in Unibase as the electrolyte; (c) general somatic activity—an electromechanical transducer attached to a platform under the subject's chair generated an electrical signal proportional to the amount of body movement in any direction; (d) pulse transmission time to the finger—a UFI photoplethysmograph was attached to the second finger of the nondominant hand. The time interval was measured between the R-wave of the EKG and the upstroke of the peripheral pulse at the finger; (e) finger pulse amplitude—the trough-to-peak amplitude of the finger pulse was measured, providing an index of the amount of blood in the periphery; (f) finger temperature—a Yellow Springs Instruments thermistor was attached to the palmar surface of the first phalange of the middle finger of the dominant hand with surgical tape; and (g) pulse transmission time to the ear—a UFI photoplethysmograph attached to the right earlobe recorded the volume of blood in the ear. This time interval was measured between the R-wave of the EKG and the upstroke of peripheral pulse at the ear.

This set of physiological measures was selected to sample broadly from major organ systems (cardiac, vascular, thermoregulatory, electrodermal, somatic muscle), to allow for continuous measurement, to be as unobtrusive as possible, and to include measures used in previous studies of marriage (e.g., Levenson & Gottman, 1983) and emotion (e.g., Levenson, Ekman, Heider, & Friesen, 1992). The computer was programmed to derive second-by-second averages for each physiological measure for each spouse.

*Nonphysiological.* Two remotely controlled high resolution video cameras, which 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 videocassette recorder. Two lavalier microphones were used to record the spouses' conversations. The computer enabled synchronization between video and physiological data by controlling the operation of a device that superimposed the elapsed time on the video recording and a second device that recorded a synchronization tone on one of the audio channels of the videotape recording. This tone was also used to synchronize the data obtained in the recall session with the data obtained in the interaction session.

## Data Reduction

*Physiological data.* Using the second-by-second data obtained for each physiological measure, we computed means and standard deviations for each spouse during each of the three conversations for the entire 15-min conversation and for the entire 5-min preconversation period.

*Affective data.* Following procedures used in earlier studies (e.g., Levenson & Gottman, 1983), for each conversation we averaged the rating dial data obtained from each spouse into 90 10-s periods. We

computed  $z$  scores for each of these periods using the mean and standard deviation of the 90 periods. Each period was then classified as being affectively positive, negative, or neutral. To be coded positive, the raw score had to be greater than or equal to 6.0 (referenced to the original 1–9 affect rating dial scales) and the  $z$  score had to be greater than or equal to 0.5. Thus, a positive classification meant that, for that period, the pointer was actually on the positive portion of the dial (the raw score criterion) and was positive relative to the subject's range of ratings during that conversation (the  $z$  score criterion). To be coded negative, the raw score average had to be less than or equal to 4.0 and the  $z$  score had to be less than or equal to  $-0.5$ .

For each spouse in each conversation we then calculated two variables that reflected the amount of affect: (a) the number of positive periods and (b) the number of negative periods. We also calculated four variables that reflected the amount of affect reciprocity: (a) positive reciprocity at lag zero—the number of positive periods for which the other spouse also rated the period as positive; (b) negative reciprocity at lag zero—the number of negative periods for which the other spouse also rated the period as negative; (c) positive reciprocity at lag one—the number of positive periods for which the other spouse rated the next 10-s period as positive; and (d) negative reciprocity at lag one—the number of negative periods for which the other spouse rated the next 10-s period as negative.<sup>2</sup>

### Results

Of the 156 couples studied, physiological data from 5 could not be used because of equipment failure or experimenter error. The final sample consisted of 45 middle-aged unhappy couples, 34 middle-aged happy couples, 31 old unhappy couples, and 41 old happy couples.

The overall design of the study was  $2 \times 2 \times 2 \times 3$  (Age  $\times$  Satisfaction  $\times$  Spouse  $\times$  Conversation), with age and satisfaction as between-subjects variables and spouse and conversation as within-subject variables. Our first two hypotheses concerned age differences in affect and physiology during marital interaction. To test these hypotheses, we focused on main effects and interactions involving the age variable. Our third hypothesis concerned gender differences in the relation between subjective affective experience and physiological activation. We tested this hypothesis using correlations between affective and physiological data. We examined the emotional qualities of satisfied and dissatisfied marriages by focusing on main effects and interactions involving the satisfaction variable. Unless otherwise noted, the .05 rejection level was used for all analyses.

#### Age Differences in Affect

The seven affect variables—rating dial (i.e., conversation mean minus preconversation mean), positive periods, negative periods, positive reciprocity at lag zero (i.e., same period), positive reciprocity at lag one (i.e., next period), negative reciprocity at lag zero, and negative reciprocity at lag one—did not lend themselves to an overall multivariate analysis of variance (MANOVA), given that preconversation means were only available for the rating dial variable, and the spouse effect was not meaningful for reciprocities in the same period. Thus, affect variables were analyzed using univariate analyses of variance (ANOVAs).

*Rating dial.* There was a significant main effect for age,  $F(1,$

147) = 7.04,  $p = .009$ , with older couples showing greater increase (from preinteraction levels) in the positivity of their affect ratings than middle-aged couples (mean change: old = .68; middle-aged = .37). No interactions involving age were significant. Greater increase in the positivity of affect ratings on the part of older couples supports our first hypothesis.

*Positive and negative periods and reciprocity.* For positive periods, there was a significant main effect for age,  $F(1, 147) = 5.03$ ,  $p = .025$ , with older couples having more positive periods than middle-aged couples (mean positive periods: old = 23.2; middle-aged = 20.2). No interactions involving age were significant. More positively rated periods on the part of older couples also supports our first hypothesis.

There were no age-related differences in the number of negative periods. In addition, there were no age-related differences in positive or negative affect reciprocity at lag zero or lag one.

#### Age Differences in Physiology

*Preconversations.* To determine whether we should test our physiological hypothesis using mean physiological levels during the conversations or using change scores (conversation mean minus preconversation mean), we conducted a MANOVA on preconversation means for the seven physiological variables (cardiac interbeat interval, skin conductance level, general somatic activity, pulse transmission time to the finger, finger pulse amplitude, finger temperature, and pulse transmission time to the ear). The structure of this MANOVA was  $2 \times 2 \times 2 \times 3$  (Age  $\times$  Satisfaction  $\times$  Spouse  $\times$  Conversation), with spouse and conversation treated as within-subject variables.

This MANOVA revealed significant multivariate effects for age,  $F(7, 128) = 4.06$ ,  $p < .001$ ; spouse,  $F(7, 128) = 37.92$ ,  $p < .001$ ; Age  $\times$  Spouse,  $F(7, 128) = 2.12$ ,  $p < .05$ ; conversation,  $F(14, 121) = 33.92$ ,  $p < .001$ ; and Age  $\times$  Conversation,  $F(14, 121) = 2.40$ ,  $p < .01$ . None of the other main effects or interactions were significant. These pervasive preinteraction differences supported the use of a change score strategy.

Because age was the focus of two of our hypotheses, we conducted univariate ANOVAs to decompose the significant age main effect. This revealed that older couples had slower heart rate, less somatic activity, lower skin conductance, and less vasoconstriction than middle-age couples, a pattern indicating that older couples were in a state of lower physiological arousal

<sup>2</sup> Two characteristics of these affect variables require comment. First, whereas in previous studies (e.g., Levenson & Gottman, 1983) we have used  $z$  scores computed from the transitional probabilities to assess affect reciprocities, here we used the simple transitional probabilities. This decision reflects the fact that, in this study, the distributions of the  $z$  scores showed greater departures from normality than did the transitional probabilities. It is also the case that transitional probabilities have the advantage of allowing for much more straightforward interpretation of findings. Second, there is the question of whether the rating dial position variable is redundant with the variables based on the number of positive and negative periods. Across the three conversations, correlations between these two types of variables ranged from .41 to .78, suggesting a sizable amount (approximately 30%–80%) of unshared variance.

during the preconversation periods than middle-aged couples (see Table 1).

**Conversations.** We analyzed the seven physiological variables (change from preconversation) with an overall  $2 \times 2 \times 3$  (Age  $\times$  Satisfaction  $\times$  Spouse  $\times$  Conversation) MANOVA, with spouse and conversation treated as within-subject variables. There were multivariate effects for age,  $F(7, 128) = 2.42$ ,  $p < .05$ ; conversation,  $F(14, 121) = 14.54$ ,  $p < .001$ ; and Age  $\times$  Conversation,  $F(14, 121) = 1.80$ ,  $p < .05$ . None of the other main effects or interactions were significant.

Univariate analyses revealed that older couples had smaller heart rate increases and greater lengthening of pulse transmission time to the ear during the conversations than middle-aged couples (see Table 2). Both of these physiological findings suggest that the conversations were less arousing for older couples, which supports our second hypothesis.

Because conversation topics were not counterbalanced, we did not consider significant main effects for conversation to be interpretable given that they confound temporal effects (e.g., habituation, sensitization) with differences in conversation topics. Conversation differences that varied for the two age groups are important; however, none of the univariate Age  $\times$  Conversation interactions were significant.

#### *Is Marital Interaction Less Physiologically Arousing for Older Couples When Age Differences in Affective Qualities of the Interactions Are Controlled?*

Knowing that the interactions of older couples were more affectively positive than those of middle-aged couples raises the question of whether these affective differences account for the finding that the interactions produced less cardiovascular activation for older couples than for middle-aged couples.

To investigate this possibility, we conducted univariate Age  $\times$  Spouse  $\times$  Conversation analyses of covariance (ANCOVAs) for change in interbeat interval and change in pulse transmission time to the ear (the two physiological variables for which we found age differences) with concomitant changes in the rating dial used as covariates. These analyses revealed that the lesser arousal on the part of older couples was maintained even when controlling for affective differences: interbeat interval,  $F(1, 141) = 7.75$ ,  $p = .006$ ; pulse transmission time to the ear,  $F(1, 140) = 5.42$ ,  $p = .021$ .

Table 1  
*Physiological Levels During Preconversation Period*

Measure	Middle age	Old	$F(1, 147)$
Interbeat interval	837.72	873.18	5.48*
Somatic activity	1.94	1.48	4.95*
Skin conductance	3.72	2.69	14.47***
Finger pulse transmission time	261.21	256.67	2.73
Finger pulse amplitude	3.37	5.92	8.06**
Ear pulse transmission time	193.73	189.69	1.52
Finger temperature <sup>a</sup>	88.65	89.30	<1.00

<sup>a</sup>  $dfs = 1$  and 146.

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

Table 2  
*Physiological Change From Preconversation Levels*

Measure	Middle age	Old	$F(1, 147)$
Interbeat interval	-15.64	-9.05	5.91*
Somatic activity	0.18	0.19	<1.00
Skin conductance	0.22	0.15	2.48
Finger pulse transmission time	-0.21	-0.44	<1.00
Finger pulse amplitude	-0.24	-0.47	2.31
Ear pulse transmission time	1.96	3.55	5.79*
Finger temperature <sup>a</sup>	-0.20	-0.21	<1.00

<sup>a</sup>  $dfs = 1$  and 146.

\*  $p < .05$ .

#### *Satisfaction and Spousal Differences in Affect*

We also examined affective differences related to marital satisfaction and spouse, issues that previously have been studied in much younger couples (e.g., Levenson & Gottman, 1983; Gottman & Levenson, 1988, 1992). Because no hypotheses were offered for these effects, we used two-tailed tests.

**Marital satisfaction.** In terms of change in rating dial, dissatisfied couples showed smaller increases in positivity than satisfied couples,  $F(1, 147) = 5.71$ ,  $p = .017$  (mean change: dissatisfied = .37; satisfied = .67). Decomposing a significant interaction of Satisfaction  $\times$  Conversation,  $F(2, 294) = 3.10$ ,  $p = .045$ , revealed that this difference was limited to the problem area and pleasant topic conversations (see Table 3).

In terms of negative periods, dissatisfied couples had more negative periods, more negative affect reciprocity at lag zero, and more negative affect reciprocity at lag one than satisfied couples (see Table 3). Decomposing significant interactions of Satisfaction  $\times$  Conversation for these three variables revealed that satisfaction-related differences were primarily found in the problem area conversation (see Table 3).

In terms of positive periods, there were no satisfaction-related differences in the number of positive periods or in positive affect reciprocity at lag zero or lag one.

**Spouse.** The number of negative periods was greater for wives than husbands,  $F(1, 147) = 6.43$ ,  $p = .012$  (mean number: wives = 10.31; husbands = 8.26). There were no spousal differences in any of the other affect variables.

#### *Spousal Differences in the Relation Between Affect and Physiology*

To explore the pattern of relations between a spouse's physiology and that spouse's affect ratings, we computed correlations between mean physiological levels during the 15-min conversation periods and three affect variables (mean rating dial during conversation, number of 10-s periods rated negative, and number of 10-s periods rated positive). We computed correlations separately for husbands and wives during each of the three conversations (see Table 4).

**Husbands.** There were no significant correlations between affect and physiology during the events of the day conversation. However, during the conflict conversation, (a) rating dial nega-

Table 3  
*Affect During Conversations*

Measure	Conversation												
	Satisfaction <i>F</i> (1, 147)	Dissat. <i>M</i>	Sat. <i>M</i>	Satisfaction × Conversation <i>F</i> (2, 294)	Events of day			Problem area			Pleasant topic		
					Dissat. <i>M</i>	Sat. <i>M</i>	<i>t</i>	Dissat. <i>M</i>	Sat. <i>M</i>	<i>t</i>	Dissat. <i>M</i>	Sat. <i>M</i>	<i>t</i>
Rating dial	5.71*	0.37	0.67	3.10*	0.51	0.65	-1.47	-0.31	0.18	-4.97***	0.93	1.17	-2.41*
Positive periods	<1.00	20.97	22.25	1.28	23.97	24.49	—	12.79	16.19	—	26.16	26.07	—
Positive reciprocity lag 0	1.71	6.83	8.10	<1.00	8.30	8.80	—	2.51	5.08	—	9.68	10.43	—
Positive reciprocity lag 1	1.79	6.65	7.93	<1.00	8.13	8.66	—	2.39	4.95	—	9.44	10.19	—
Negative periods	12.98***	11.18	7.37	5.73**	8.69	6.59	1.79	20.29	13.24	6.01***	4.55	2.29	1.93
Negative reciprocity lag 0	6.32*	3.14	1.71	9.17***	1.61	1.72	-0.16	7.17	3.12	5.53***	0.66	0.28	0.52
Negative reciprocity lag 1	5.88*	3.01	1.66	8.83***	1.55	1.67	-0.16	6.87	3.03	5.37***	0.60	0.28	0.45

Note. Dissat. = dissatisfied couples; Sat. = satisfied couples.  
\* *p* < .05. \*\* *p* < .01. \*\*\* *p* < .001.

tivity was correlated with high levels of general somatic activity, *r* = -.20, *p* = .014, and small finger pulse amplitudes, *r* = .18, *p* = .030; (b) the number of periods rated negative was correlated with high levels of general somatic activity, *r* = .21, *p* = .008, small finger pulse amplitudes, *r* = -.22, *p* = .008, and long

pulse transmission times to the ear, *r* = .17, *p* = .039; and (c) the number of periods rated positive was correlated with low levels of skin conductance, *r* = -.17, *p* = .042. During the pleasant topic conversation, rating dial negativity was correlated with short interbeat intervals (i.e., fast heart rates), *r* = .17, *p* = .043,

Table 4  
*Correlations Between Affect and Physiology*

Affect measure	IBI	ACT	SCL	FPT	FPA	EPT	TEM
Husband							
Events of the day							
Rating dial	-.04	.07	-.12	-.08	-.09	-.03	.00
Positive periods	-.03	.02	-.11	-.05	-.06	-.04	.03
Negative periods	.00	.05	.10	.10	-.08	.12	-.07
Problem area							
Rating dial	.11	-.20*	-.07	-.14	.18*	-.09	-.11
Positive periods	.15	-.16*	-.17*	-.02	.12	.03	-.08
Negative periods	-.04	.21**	-.07	.11	-.22**	.17*	.07
Pleasant topic							
Rating dial	.17*	.04	-.17*	.02	-.10	.17*	-.23**
Positive periods	.04	.07	-.11	-.04	-.06	.08	-.06
Negative periods	.10	-.05	.01	.03	.04	.00	.06
Wife							
Events of the day							
Rating dial	.06	-.07	-.03	.11	.05	.05	.00
Positive periods	.02	.06	-.02	.06	-.06	.13	-.01
Negative periods	.11	.08	.16	-.03	.00	.04	.04
Problem area							
Rating dial	.06	.03	.00	-.01	-.01	-.05	.02
Positive periods	.09	.05	.02	.07	-.03	.00	.02
Negative periods	-.08	-.05	.06	-.00	-.07	-.07	.05
Pleasant topic							
Rating dial	.04	-.08	.04	.01	.04	.01	-.00
Positive periods	-.02	-.01	-.01	-.00	.06	-.03	.02
Negative periods	.13	-.12	.01	.03	.13	-.10	.00

Note. IBI = cardiac interbeat interval; ACT = general somatic activity; SCL = skin conductance level; FPT = pulse transmission time to the finger; FPA = finger pulse amplitude; EPT = pulse transmission time to the ear; TEM = finger temperature.  
\* *p* < .05. \*\* *p* < .01.

high skin conductance levels,  $r = -.17$ ,  $p = .034$ , short pulse transmission times to the ear,  $r = .17$ ,  $p = .043$ , and high finger temperatures,  $r = -.23$ ,  $p = .005$ . These findings of significant correlations between physiological arousal and negative affect for husbands support our third hypothesis.

*Wives.* There were no significant correlations between physiology and affect ratings for wives for any of the three conversations. This finding of a lack of correlation between physiological arousal and affect for wives also supports our third hypothesis.<sup>3</sup>

### Discussion

This study of marital interaction in long-term marriages in middle-aged and older couples revealed age, satisfaction, and spousal differences in physiology, affect, and their interrelations. Support was derived for three major hypotheses: (a) Marital interaction is more affectively positive for older couples than for middle-aged couples, (b) marital interaction is less physiologically arousing for older couples than for middle-aged couples, and (c) negative affect is associated with high levels of physiological arousal for men, but affect and arousal are uncorrelated for women. In addition, the affective qualities that distinguish dissatisfied marriages from satisfied marriages in younger couples (i.e., less positivity, greater negativity, and greater negative affect reciprocity) were also found to typify dissatisfied marriages in later life.

### Limitations

Before discussing these findings, we must mention several limitations to the generalizability of findings derived from this study. First, the design was entirely cross-sectional, thus cohort and age differences are inextricably commingled. Furthermore, age differences may also reflect the results of selective attrition. For example, dissolution of more affectively negative middle-aged marriages before couples reach old age could change the population of older marriages so as to contribute to findings of greater affective positivity in older than in middle-aged marriages. Although we generally interpret found age differences in terms of hypothetical processes that unfold within marriages over time, it is only with the kind of longitudinal follow-up that we hope to be able to conduct with this sample that these alternative explanations can be adequately evaluated. Second, in any study of age and marriage, confounds between age and marital duration are likely. In the present study, this confounding was increased by our decision only to study long-term marriages. Although we relate our age-related findings to those derived from studies that may have had less of this kind of confounding, we cannot eliminate the possibility that differences that we ascribe to age could be due wholly or in part to the effects of marital duration.

### *Hypothesis 1: Marital Interaction Is More Affectively Positive for Older Couples Than for Middle-Aged Couples*

Older couples reported greater increase in positive affect during marital interaction than did middle-aged couples. This

finding (based on rating dial data) is consistent with findings of others (derived from questionnaire data) that marital positivity increases with age (e.g., Guilford & Bengtson, 1979). This is also consistent with other findings obtained from the present sample of long-term marriages. In response to questionnaires, older couples indicated that they derived more enjoyment from a number of topics than did middle-aged couples (Levenson et al., 1993), and when objective coders rated the emotional behaviors expressed during the problem area interactions, they rated older couples as more affectionate than middle-aged couples (Carstensen, Gottman, & Levenson, 1993). Thus, there is convergent evidence across numerous data sources of greater positivity in older marriages.

It is important to contrast these findings of greater emotional positivity in old age with earlier theories, which consistently depicted old age as a time of dampened, rigid, and flat emotionality (Banham, 1951; Jung, 1933; Looft, 1972). Our data present a quite different picture; not only is emotionality still intact in late-life marriages, but there is actually more positive emotion than in middle-aged marriages. One might ask how it is that the emotional economy of late-life marriages comes to have this positive affective quality and, especially, whether older spouses assume an active or passive role in this process.

Although our data do not speak directly to the processes involved, there is increasing evidence that older people assume a highly active stance in designing their emotional environments (Lawton, 1989; Schulz, 1985). Socioemotional selectivity theory (Carstensen, 1992, 1993) suggests that, with age, people choose social partners who provide the greatest potential for positive emotional experience and that older people actively regulate their social interactions to maximize emotional benefits. In late life, as social networks begin to shrink, marriage looms increasingly large on the individual's social landscape. Unlike other domains in which decrements in functioning are the rule, older people show evidence of improved functioning and competence in the realm of emotion, such as in emotional control (Lawton, Kleban, Rajagopal, & Dean, 1992) and in emotional understanding (Labouvie-Vief & DeVoe, 1991; Labouvie-Vief, Hakim-Larson, DeVoe, & Schoeberlein, 1989). For all of these reasons, it seems to us most likely that older people, making good use of their emotional expertise and competence, take a highly active role in designing and optimizing the emotional environment in their marriages.

<sup>3</sup> We analyzed spousal differences in variability in the physiological and rating dial measures to determine if this was a viable explanation for the differences found in the pattern of significant correlations. ANOVAs were conducted using the standard deviations (over each 15-min conversation) as the dependent measure. These analyses revealed no spousal differences in variability for heart rate, general somatic activity, finger pulse amplitude, and pulse transmission time to the ear. Spousal differences were found for variability in skin conductance,  $F(1, 147) = 21.14$ ,  $p < .001$ , pulse transmission to the finger,  $F(1, 147) = 6.55$ ,  $p = .011$ , finger temperature,  $F(1, 144) = 37.94$ ,  $p < .001$ , and for the affect rating dial,  $F(1, 147) = 7.22$ ,  $p = .008$ , but, in each instance, it was wives who had the larger variability. Thus, we conclude that it is unlikely that restricted variability on the part of wives could be responsible for our findings.

*Hypothesis 2: Marital Interaction Is Less Physiologically Arousing for Older Couples Than for Middle-Aged Couples*

Support for this hypothesis was derived from findings that marital interaction was less cardiovascularly arousing (in interbeat interval and in pulse transmission time to the ear) for old couples than for middle-aged couples. Given that positive emotional states such as happiness and calm are likely to be less physiologically arousing than negative emotional states (e.g., Levenson, 1988; Levenson et al., 1990), it was certainly possible that the greater affective positivity of older couples' interactions was responsible for the reduction in attendant physiological arousal. However, these age differences in physiological arousal were maintained even after controlling for the affective quality of the interactions. Thus, within the limits of our cross-sectional design, these data suggest that, in long-term marriages, interaction may become less cardiovascularly arousing over the years.

We can only speculate as to why marital interaction, at comparable levels of subjective affect, would become less cardiovascularly taxing with age. Let us first consider several purely physiological explanations. In terms of basic physiological mechanisms, we can rule out initial values and ceiling effects; the fact that older couples showed lower levels of activation during the preconversation period than middle-aged couples would, if anything, work in favor of larger reactions on the part of old couples. Nonetheless, we cannot rule out the possibility that older people are simply less physiologically reactive in general than middle-aged people. Pertinent to this point is the evidence reviewed earlier of a general dampening of end-organ autonomic reactivity with age. In this regard, our own work (Levenson et al., 1991), showing that older individuals manifest smaller autonomic activation during specific emotions, may be particularly relevant. Demonstrating whether age brings about a reduction in the autonomic activation occasioned by emotion that is incrementally greater than the age-related reduction in general autonomic reactivity would require assessing reactivity to both emotional and nonemotional stimuli. Not having these kinds of data at this time, we cannot settle this issue.

Physiological factors notwithstanding, we certainly believe that psychological factors also play an important role in these findings. In couples who have been married most of their adult lives, discussion of maritally relevant topics may come to have a certain comfort and familiarity, as issues are viewed in the context of decades of life together. The emotional quality surely still remains, but issues that might be viewed as highly threatening in younger marriages inspire less of a sense of emergency in older couples, and thus, the associated demand for autonomic activation is lessened.

*Hypothesis 3: Negative Affect and Physiological Arousal Are Related for Husbands, but not for Wives*

Support for this hypothesis was derived from a correlational analysis. Whereas husbands showed a number of small but reliable correlations between affective negativity and physiological arousal during the problem area and pleasant topic conversations, for wives, there were no significant correlations between

affect and physiology for any of the three conversations. Our confidence in these findings is increased by the fact that correlations between affect and physiology for husbands encompassed six of the seven measured physiological variables. Husbands' affective negativity was associated with faster heart rates, greater somatic activity, greater skin conductance, and warmer finger temperature (warmer temperature was associated with anger in our previous studies of physiological changes in emotion; e.g., Levenson et al., 1990; Levenson, 1992). Husbands' affective negativity was also associated with pulse transmission time to the ear, but the relationship was different during the problem area discussion (associated with longer times) and the pleasant conversation (associated with shorter times). With one exception (i.e., longer pulse transmission time to the ear during the problem area discussion), all of these significant correlations could be described as indicating that husbands reported feeling more negatively to the extent that they had been physiologically aroused during the interaction session.<sup>4</sup>

*Implications for Our Theoretical Model of Gender Differences in Marriage*

These findings lend support to and help refine our theoretical model of gender differences in marital behavior (Gottman & Levenson, 1988). We have argued that the oft-observed tendency of men to withdraw and women to continue to engage during conflictive marital interaction (e.g., Christensen & Heavey, 1990; Gottman & Krokoff, 1989; Notarius & Johnson, 1982; Schaap, 1982) results from men experiencing states of high physiological arousal as being unpleasant, whereas women do not. In our model, male withdrawal is highly reinforced both in the short-term (allowing them to reduce levels of physiological arousal and to feel less negative) and in the long-term (allowing them to avoid the health-damaging consequences of sustained physiological arousal; e.g., Henry & Stephens, 1977; Holroyd & Gorkin, 1983; Krantz & Manuck, 1984; MacDougall, Dembroski, & Krantz, 1981; Steptoe, 1981). The finding in the present study that men's experience of negative affect was correlated with their level of physiological arousal, and women's experience of negative affect was not correlated with their level of arousal, supports a critical link in the model.

<sup>4</sup> One noteworthy feature of this relation is that the physiological data were obtained at one time—during the initial interaction session—and the affective data were obtained several days later, when subjects viewed the videotapes of those interactions. Thus, at the time the ratings were being made, it might be thought that subjects would not have available to them any cues that arose from the original physiological arousal. However, we know from previous studies that viewing videotapes of these kinds of marital interactions has the capacity to produce patterns of physiological activation that are similar, albeit smaller in amplitude, to those produced in the original interaction. We have demonstrated this phenomenon both in spouses viewing and rating videotapes of their own marital interactions (Gottman & Levenson, 1985) and in empathic individuals viewing and rating the videotapes of strangers (Levenson & Ruef, 1992). For this reason, it is entirely possible that, at the moment these affect ratings were being made, spouses were in a physiological state similar to that of the original interaction and, thus, may have had available to them some of the same physiological cues.

Unfortunately, our data cannot tell us whether husbands and wives differ in awareness of how physiologically aroused they have become during these interactions. The possibility certainly exists that men are more aware of their level of physiological arousal than women, a notion that is supported by theory (Pennebaker & Roberts, 1992), studies of visceral perception (e.g., Harver et al., 1993; Katkin et al., 1981), and studies of the relation between perceived effort and cardiovascular change (e.g., Koltyn et al., 1991).

Following this conjecture a bit further, male withdrawal from conflictive interactions may be motivated by a conscious or unconscious desire to reduce negative affect or to reduce perceived physiological arousal, or both. Women, in contrast, being less encumbered by direct awareness of their high levels of physiological arousal and not experiencing negative affect when physiologically aroused, would be less likely to withdraw and more likely to remain engaged.

### *Implications for Gender Differences in the Relation Between Marital Satisfaction and Health*

We believe that these gender differences may have implications that go beyond merely highlighting an interesting difference in modal male and female behavior during marital interactions. Health data from these couples reveal that only wives' health is related to marital satisfaction, with lower marital satisfaction being related to wives' lower physical and psychological health; for husbands, marital satisfaction and health are not related (Levenson et al., 1993). These findings, and those of others (Hess & Soldo, 1985), suggest that wives only receive a health benefit from being married if the marriage is happy. Husbands, in contrast, appear to receive a health benefit merely from being married (Helsing, 1981; Radloff, 1975; Russo, 1985), regardless of whether the marriage is happy or unhappy (Hess & Soldo, 1985).

Why might this be? We believe that part of the explanation resides in male withdrawal behavior, which enables husbands to reduce physiological levels whenever they experience sustained, heightened negative affect or perceive that they are physiologically hyperaroused. Women, who have no particular tendency to feel negative affect when physiologically aroused, have less direct awareness of their level of physiological arousal, and are socialized to be the primary problem solvers in relationships, are likely to persist in their attempts to confront marital difficulties. One result of this perseverance is that wives are likely to remain in states of heightened physiological arousal much longer than their husbands. If sustained autonomic arousal is accepted as playing a role in the etiology of disease, then the health of women would be expected to suffer most in the most unhappy marriages, which are the marriages most likely to have intractable problems and repeated bouts of high-level conflict.

### *A Caveat*

Having engaged in this speculation concerning the implications of a possible gender difference in the relation between negative affect and physiological arousal, it should be noted that the magnitude of this relation for men was not very large. Nonethe-

less, we believe that, over the course of a lifetime, the cumulative effects of even a small gender difference such as this could have meaningful implications for gender differences in marital behavior and health.

### *Are the Affective Qualities of Older Dissatisfied Marriages Similar to Those of Younger Couples?*

Finally, we turn to the relationship between affect and marital satisfaction and to the question of whether there is age-related continuity in the relation between affect and marital satisfaction. Absent the present data, it might have been argued that, over the course of a long-term marriage, couples would habituate to the unpleasant effects of negative affect and negative affect reciprocity and thus their capacity to corrode the quality of the marriage would lessen. However, in this sample of long-term marriages, interactions that were experienced as being less positive and more negative and that produced greater negative affect reciprocity were characteristic of dissatisfied marriages. These distinguishing affective qualities of the interactions of dissatisfied marriages emerged most clearly during attempts to resolve marital problems. In addition, there were no indications that the relation between affect and marital satisfaction differed as a function of age (i.e., all interactions of age and satisfaction were nonsignificant). These findings with older and middle-aged couples closely parallel those derived from the large number of observational studies (reviewed in the introduction to this article) that have primarily studied much younger couples. Thus, it appears that an emotional climate of high negative affect, high negative affect reciprocity, and low positive emotion when working on marital problems may be a marker of marital distress in all age groups, even in marriages that span decades.

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