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Transitions From Negative Affect During Marital Interaction: Husband and Wife Differences

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Negative-affect expression during marital interaction is the most consistent and powerful discriminator of marital quality. This negative-affect expression may also be influenced by gender. This investigation examined how covariates differentially influence, by gender, the "transitioning out" of negative affect during marital interaction. Self-report of negative affect was gathered in real time from 19 couples immediately after a positive interaction and a negative interaction. Event history analysis was used to determine covariate influence on the negative-affect hazard rate. Results indicated substantial gender differences. Wives were influenced by marital satisfaction, communication orientation, education, and previous durations of negative affect, whereas husbands were influenced only by education. For husbands, evidence was found suggesting that some covariate effects were moderated by time already spent in the negative state.

As a unit of study, the marital dyad has a long history. Initial research sought to uncover the determinants of marital quality (Terman, Buttenweiser, Ferguson, Johnson, & Wilson, 1938), and although this line of study still continues, work linking marital quality with psychological and physiological maladies for the dyad members and their children has increased the visibility of marital-dyad research. For example, depression (Hops, Biglan, Sherman, Arthur, Friedman, & Osteen, 1987), spouse abuse (Margolin, John, & Gleberman, 1988), and alcohol abuse (Jacob & Krahn, 1988; O'Farrell & Birchler, 1987) are now associated with marital distress. Marital quality also affects health. There is, for example, evidence that an individual's immunological functioning is moderated by perceived marital satisfaction (Kiecolt-Glaser, Fisher, Ogrocki, Stout, Speicher, & Glaser, 1987; Kiecolt-Glaser, Kennedy, Malkoff, Fisher, Speicher, & Glaser, 1988) or by the loss of a significant other (Bartrop, Lazarus, Luckhurst, Kiloh, & Penny, 1977). In addition, in the presence of an existing disease, symptom expression appears to covary with reported marital quality. This has been shown in such chronic illnesses as rheumatoid arthritis (Williamson, Brenner, Robinson, & Melamed, 1989), Parkinson's disease (Griffin & Greene, 1991, in press), and chronic pain (Kerns, Haythornthwaite, Southwick, & Giller, 1990). Finally, the impact of the marital quality also extends to individuals beyond the dyad; numerous studies have consistently demonstrated a relationship between marital distress and child-behavior problems (see Emery, 1982, for a review).

Although the association between marital quality and the aforementioned physical and psychological manifestations is now consistently reported, the specific mechanisms generating this relationship are not known. As a result of the recency of these findings no single generating mechanism has been accepted in the literature (see e.g., Gottman, 1990); yet among the several that have been forwarded, all contain a common element: negativity. This refers to the general domain of negative verbal and nonverbal behavior and negative affect (see Weiss & Heyman, 1990, for a review).

Across various methodologies (interaction, self-report, quasi-observation), studies, and research laboratories, negative behavior discriminates distressed from nondistressed relationships (Gottman & Levenson, 1986; Schaap, 1984). Specifically, relative to nondistressed

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couples, distressed couples exhibit disproportionately more negative affect and negative-affect reciprocity during their interactions. In short, negative affect is the most potent discriminator of marital quality than any other single independent variable (Notarius, Benson, & Sloane, 1989).

Concomitant with the amassed evidence that negative affect is the prime discriminator of couple quality, there is accumulating evidence that husbands and wives differentially produce and react to negative affect (Baucom, Notarius, Burnett, & Haefner, 1990; Roberts & Krokoff, 1990). From their review of the literature and from their own work, Gottman and Levenson (1986, 1988; Gottman, 1990) concluded that wives, in general, are more negative, more willing to engage in conflict, more willing to escalate conflict, and better able to handle conflict. In contrast, men are less negative, seek to reduce conflict, and are generally less competent at handling conflict. In effect, wives, especially those who are distressed, tend to engage and maintain a general negative state, whereas husbands attempt to withdraw from conflict. These investigators further postulated that the husband's interaction style is used to compensate for his biological predisposition to remain physiologically aroused after periods of provocation or conflict. Drawing from the physiological literature, these investigators additionally postulated that the husband's propensity to remain aroused has long-term negative health consequences (see Appel, Holroyd, & Gorkin, 1983, for a review). In effect, because negative affect is more costly for males than females, husbands attempt to interact in a style that terminates conflict, usually by withdrawal (Gottman, 1990; Gottman & Levenson, 1988). Although these conclusions may be considered premature and speculative (see Weiss & Heyman, 1990), a basic supposition in the published literature is that the likelihood at any given moment that an individual enters or exits negative affect during a dyadic conversation is contingent, at least minimally, on marital quality and gender.

Although numerous studies exist indicating the relevance of proportion and reciprocity of negative affect during interaction, none have incorporated real-time duration of negative affect in the analysis of dyadic interaction. Recently, the analysis of state duration, as well as sequence, has been proposed by some economists (Heckman & Singer, 1985), sociologists (Diekmann & Mitter, 1984; Tuma & Hannan, 1984; Vuchinich, Teachman, & Crosby, 1991), and psychologists (Gardner & Griffin, 1989; Griffin & Gardner, 1989) as being a more realistic representation of social processes than the assumption of a time-invariant movement across events. Acknowledging duration variability implies, in effect, that, within the context of an interaction, a short-duration behavior may have a different meaning than the same behavior of longer duration (Birdwhistell, 1970); a similar opinion has been expressed regarding emotion expression (Ekman, 1984).

Despite our knowledge of the role negative affect plays in marital quality, there is no research on the real-time movement in and out of negative affect. For example, the aforementioned gender literature describes wives as extenders of negative affect and husbands as terminators of negative affect, yet this ascribed propensity to lengthen or shorten the negative spell has not been directly assessed or analyzed using real-time self-report data. At present, conclusions have been made on the basis of time-invariant outside observer coding of affect (e.g., SPAFF, Gottman & Krokoff, 1989), extended sequences measured by floor switches (Gottman, 1979), discrete time-invariant intervals (e.g., Conger & Smith, 1981), coder ratings of negative affect (Roberts & Korkoff, 1990), or continuous self-report of affect (Gottman & Levenson, 1985). Although the latter method records in real time, the authors elected to investigate the time-series features of the data and not the dynamic process of affect-state movement.

An effective and comprehensive model of marital interaction should address both the temporal and sequential patterning in dyadic interaction (Gottman, 1982). These are interdependent components of any behavioral pattern. Sequence provides structure; duration adds the contextual meaning. For example, work examining negative-state transitions during family conflict suggests that time in conflict influences the likelihood of a physically abusive outcome (Reid, 1986). In the marital literature, no prior study has examined negative affect exiting rates, which variables might influence these exit rates, or whether the rates vary by gender in accordance with existing literature.

The present study sought to determine whether similar covariates differentially influ-

ence the speed that husbands and wives transitioned from negative affect during a conversation. Although the present report is not intended as a test of the Gottman-Levenson model, several positions in their model are relevant to the analysis of these data. First, because of the suggested gender differences, husbands and wives were analyzed separately. Second, because of their willingness to continue conflict, wives should have longer durations in negative affect. Aside from these points, the existing literature provides no additional information for hypothesizing how the variables should influence duration in negative affect.

Method

Subjects

The sample consisted of 19 married couples living in a large metropolitan city in the Southwest. They responded to newspaper advertisements offering money for participation in a study on marital communication. All but 2 individuals were White. The mean age of the husbands was 32.89 years (SD = 7.17), and the mean age of the wives was 30.47 (SD = 5.86). Subjects had known each other an average of 2.34 (SD = 1.41) years before marriage and had been married an average of 5.56 (SD = 5.6) years. A substantial proportion (34.2%) of the subjects had been in a previous marriage.

Procedure

Couples were seated in a room constructed to resemble a small living area containing prints, curtains, plants, and two chairs in the center of the room. Two unobtrusive, partially concealed, remotely controlled cameras were mounted on the walls at head level behind each chair. All audiovisual and mixing equipment was controlled from a room adjacent to the interaction. Video signals were combined producing a split-screen image; audio was obtained from lavaliere microphones worn by each spouse.

Interaction Task

Each couple engaged in two 12-min conversations about their relationship, one focusing on problem areas and the other on pleasant memories.

Pleasant memories (positive). The initial interaction was designed to provoke a discussion about pleasant memories of the relationship. To generate these memories, couples completed the Pleasant Memories Inventory (Griffin, 1988). This 10-item inventory had couples rank periods or events in their relationship that are typically thought to be pleasant (e.g., "the first time you met," "the wedding: who, what, when and where"). After each spouse completed the inventory, the couple, with the help of an assistant, ranked the events relative to their enjoyment. The couple was then asked to reminisce about the top three choices.

Problem areas (negative). Couples were asked to rank problem areas in their relationship using the Areas of Disagreement Inventory (Gottman, 1979). Each spouse selected, from a list, common problems areas in a relationship, and then the couple ranked the areas. Three areas were selected, and the couple was instructed to discuss and attempt to resolve the issues. This is a common task used to evoke negative interaction in married dyads.

Affect Generation

Spouses were separated immediately after each conversation and then simultaneously reviewed the videotaped split-screen playback and rated his or her own affect during the interaction. A study using similar methodology for recalled self-report of affect reported validity for the procedure with respect to observational coding (Gottman & Levenson, 1985). The videotape was played back through a specially configured microcomputer using software that overlays a nine-level, color-coded vertical bar on the color video monitor. This overlay was positioned beside the face on the monitor of the individual reviewing the tape. The affect rating ranges from extreme negative (red) to neutral (gray) to extreme positive (blue) and is controlled by a personal computer mouse. Extreme negative is at the bottom of the monitor, neutral is midmonitor, and extreme positive is at the top of the monitor. The width of the bar varies at each affect level (five-pixel increments) corresponding to the intensity of the affect, with neutral being the thinnest. The widest affect level is 28 pixels wide (1.5 cm). As the reviewer moves the mouse, the affect bar is highlighted corresponding to the degree and direction of the affect. For example, as the individual's affect rating becomes more negative (positive), the mouse is pulled back (pushed forward), and the appropriate affect level becomes highlighted, and as the highlighted area moves further from neutral, the width of the level expands to reflect intensity. During the review of the tape, and viewing only his or her own rating, each spouse was asked to move the mouse to reflect affect experience during the interaction (i.e., "How were you feeling at each moment?").

In this study, each affect has a subjective reference that is unique to the rater within the context of the interaction given the dyad's history. For each individual, there is only an internal template referencing a positive-affect state, a neutral state, or a negative-affect state. In effect, an internal state that is pleasant to one individual may be only neutral to another. To answer the questions posed in this study—specifically what factors influence the movement in and out of gross negative affect—this subjectivity provides the appropriate information. In addition, because it is a self-report, it could be argued that such a recall procedure provides a good proxy of the true affect state and

requires less inference than other, outsider-perspective data-collection procedures.

Software recorded the location of the bar position every second, providing a continuous measure of affect throughout the interaction. Before the first interaction task, each couple was taught how to use the rating system.

The wives' average rating during the positive interaction was 4.04, which was significantly higher than the 3.09 average rating during the negative interaction (correlated $t = 4.86$, $p = .000$, $n = 18$). For husbands, their positive interaction rating was 3.96, which was also significantly higher than their 3.15 average rating during the negative interaction (correlated $t = 4.72$, $p = .000$, $n = 18$). Average ratings are referenced to a reduced 5-point scale: 1 and 2 = negative, 3 = neutral, and 4 and 5 = positive.

Variables

The literature was reviewed and a number of variables were found to be relevant to this study, because of their association with negative-affect expression during marital interaction or with gender differences during marital interaction or both. To pare the number of covariates, variance, covariance, and bivariate correlation matrixes were used to identify unique sources of information and thereby reduce problems of multicollinearity. The reduced list of covariates is intended to provide sufficient representation across the three variable types: context, couple, and individual.

Contextual variables. These are variables that provide information about the dyadic interaction, its design, and its process. Included are Task, Tally, Instate, Previous State, Autocorrelation Function at Lag 1 (Ac.f. 1), and Previous Duration. These variables provide a measure of the individual's history. By including these covariates in the event history regression model, an attempt was made to account for, and thus minimize, the effects of unobserved population heterogeneity (Griffin, 1993) and the consequences of using nonindependent entries in the data set (Allison, 1984; Hutchison, 1988). Unobserved heterogeneity refers to personal and environmental characteristics that are not recorded or that remain unknown but yet influence the hazard rates (see Blossfeld, Hamerle, & Mayer, 1989).

Task refers to the type of interaction (positive or negative). It reflects whether the couple was asked to discuss positive memories or a marital problem. If the odds of entering a negative state are directly related to the propensity of leaving a negative state, then observational literature suggests that during the negative task there will be more negative events, each, on average, having longer durations. However, the relationship between frequency and duration is not known; hence, no prediction about durations can be made. For analysis, Task was dummy coded with positive = 0 and negative = 1. Tally refers to the cumulative number of prior negative states within the current task. This was included to determine whether the number of events have an accumulative effect on the hazard rate. Although within each dyad these transitions have occurred hundreds or thousands of times, within the context of the experimental design, these transitions may have a cumulative effect. Although this variable may have substantial value, its inclusion more likely controls for unobserved heterogeneity. In these data, there were 265 events (transitioning from negative state) for husbands (90 occurred during the positive task and 175 occurred during the negative task); for wives, there were 212 (85 and 127, respectively). Instate refers to the absolute duration within the task; it is the clock time since the onset of the task. The inclusion of this variable examines whether cumulative time influences the hazard rate. Aside from providing contextual information, significance of this variable suggests that the interactional process (i.e., state transition) changes as the task progresses, indicating that individual or dyadic processes react to the accumulative time spent discussing the selected topics. Previous State refers to the immediate previous state, either neutral or positive. It was included to determine whether the affective state previously occupied influences the current state duration. This was included to determine whether, for example, having previously occupied a neutral state, as opposed to a positive state, increases the immediate likelihood of exiting the current negative state. It seems that coming from a positive state might lessen the duration of the subsequent negative state; however, this is conjecture and needs to be tested. Ac.f. 1 is the Lag 1 autocorrelation function for negative-affect durations and was included as a measure of general serial dependency for duration. Ac.f. 1 provides a measure of whether and how consistency in transitioning behavior (i.e., duration) influences the likelihood of immediately exiting the current negative state. All estimates for Ac.f. 1 were done using the correction for small samples recommended by Huitema and McKean (1991). For wives, the range was $-.27$ to .59 ($M = .05$, $SD = .15$), and for husbands the range was $-.34$ to .50 ($M = .03$, $SD = .16$); only 1 subject, a wife, had a significant Ac.f. 1 ($t = 2.53$, $p < .05$). To derive reasonable estimates of Ac.f. 1, only individuals having at least five negative episodes ($n = 31$) were involved in the calculations; the remaining 7 subjects were assigned Ac.f. 1 = 0. Finding only one significant t using this conservative estimation procedure suggests that negative-state durations were only nominally autocorrelated. Previous Duration refers to the duration of Previous State. This covariate was included to estimate the effect of the duration of the prior state, either positive or neutral, on the likelihood of immediately exiting the subsequent negative state.

Couple variables. These variables reflect a couple trait, or that the unit of measurement is at the couple level; they are Marital Length and Spouse Rating. Initial consideration of variables for this section included other relevant variables (e.g., couple marital satisfaction score); however, because of information redundancy and multicollinearity as a consequence, variables were either included at the couple or individual level or dropped from the analysis. For example, Age was correlated with Marital Length (husbands: $r = .54$; wives: $r = .65$) and was thus dropped

from the analysis because Marital Length better reflects a history of joint processes that produce interaction patterns of greater relevancy to the present study.

Marital Length is a measure of how long the couple had been married. Although most studies used couples within a restricted age range, there is some evidence that marital length influences interaction patterns (see Schaap, 1984). For example, Ullman-Page (1978) reported that as couples age, fewer negative behaviors are reported on a day-to-day basis, yet relative to younger couples, each negative behavior has a greater impact on perceived happiness. However, the influence of marital length on how long an individual remains in a negative state cannot be predicted from existing literature. Spouse Rating refers to a score reflecting the spouse's averaged affect rating for the concurrent second plus the previous 3 seconds. For example, should the wife exit negative affect at 3:23, her spouse Rating score would be an average of the husband's affect ratings from 3:20 to 3:23. This variable is thought to reflect the individual's reactivity to the immediate behavior of the spouse, assuming that affect is telegraphed during the interaction. It is constructed to reflect a general measure of the rater's reaction to possible overt behavior or leakage by the partner. However, if no leakage occurs, or the rater is oblivious to the partner or simply elects not to respond to the partner, no association will be found between this covariate and the hazard rate. Conversely, if an association is found, this suggests that affect is being telegraphed and responded to by the rater. In addition, although published literature has consistently noted the superior encoding and decoding ability of females for nonverbal and emotion cues (see Noller, 1984; Sade & Notarius, 1985), to speculate how these abilities will influence this variable is premature.

Individual level. The individual level variables are Education, Marital Satisfaction, and Communication Orientation. Education has a long history of being used in survey research as a determinant of marital satisfaction although without much evidence of impact (Glenn & Weaver, 1978). It may, however, influence the likelihood or willingness of women to express dissatisfaction with their marital relationship. Specifically, education may provide women with either the necessary tools or leverage in the relationship to express dissatisfaction. If and how education relates to the willingness to maintain negative affect is unknown. In these data, wives' formal education averaged 13.57 years (SD = 1.70), and husbands' formal education averaged 14.10 years (SD = 2.64). Marital Satisfaction was assessed using the Locke-Wallace Marital Adjustment Test (MAT; Locke & Wallace, 1959). Widely used, the MAT has the greatest number of reliability and validity studies of all self-report marital adjustment measures (Cohen, 1985). Although an older instrument, it correlates highly with newer instruments (approximate r = .90), and it permits comparisons to the majority of other marital interaction studies and their samples (Crane, Allgood, Larson, & Griffin, 1990). The average couple MAT score was 112.76 (SD = 21.30), for husbands the mean MAT score was 110.68 (SD = 26.83), and for wives the mean score was 114.84 (SD = 20.66). Gender differences were not significant (correlated t = −.39, ns, n = 19). One consistent finding throughout the marital interaction literature is that expressed marital dissatisfaction is the strongest predictor of negative-affect expression, especially among distressed wives (Notarius & Pelligrini, 1987; O'Leary & Smith, 1991; Weiss & Heyman, 1990). Although the literature suggests that individuals in distressed relationships exhibit more negative affect, the relationship between this exhibition and maintaining a negative internal state is, at present, unknown. In addition, although the relationship between frequency and duration is unknown, given the consistency in the literature it is hypothesized that women will maintain negative affect longer.

Communication Orientation is from a questionnaire developed by Krokoff (Krokoff, Gottman, & Roy, 1988) to determine the extent to which the respondent believes it is important to discuss problems and confront disagreements in their relationship. Like Marital Satisfaction, this is a global variable; yet unlike Marital Satisfaction, which reflects how various components of the relationship are currently functioning, Communication Orientation measures the perception of the value of discussing with others inter- and intrapersonal problems, especially those arising in the marriage. It was included because of the possible relationship between one's perceived value in discussing conflictual issues and the propensity to stay in negative affect. Although these are different dimensions of marital interaction, it is conceivable that they covary in some systematic manner. For example, an individual who expresses a higher need to discuss marital issues may view negative affect as a mere side effect of discussing marital concerns and hence would feel comfortable staying longer in negative affect. In fact, these engager types (Raush, Barry, Hertel, & Swain, 1974) may be benefiting the marriage over the long term (see Gottman & Krokoff, 1989). At present, however, the relationship between the perceived value of discussing issues and the propensity to stay in negative affect is not known. Composed of 20 Likert-type items (strongly agree/strongly disagree), this questionnaire has acceptable internal consistency (Krokoff et al., 1988). A lower score suggests a greater willingness and perceived value in having discussions about the relationship. Husbands had a mean score of 55.68 (SD = 9.55), and wives had a mean score of 47.52 (SD = 9.15); these differences were statistically significant (correlated t = 2.71, p = .01, n = 19). Cronbach's alpha showed adequate internal consistency; alpha is .83 for wives and .85 for husbands.

Data Analysis

Although affect was recorded in nine incremental levels from neutral to either extreme, to simplify data analysis and interpretation, the data were collapsed to negative-affect, neutral, or positive-affect states. To exit a negative state,

the rating needed to move to a nonnegative state (neutral, positive). Movement for extreme negative to less negative was considered a within-state movement and not a transition from the negative-affect state.

The basic unit of analysis in these data is the duration of the negative-affect episode. Event history analysis was used to model the influence of explanatory variables on these durations (Allison, 1984; Singer & Willett, 1991). An introduction to this data-analytic procedure is given in Griffin (1993). Application of this method to couple and family interaction has been illustrated elsewhere (Gardner & Griffin, 1989; Griffin & Gardner, 1989; Vuchinich et al., 1991).

The dynamic process of transitioning from a negative-affect state influenced by covariate observations is described by the hazard function or rate. Although not a true probability, the hazard rate reflects the instantaneous likelihood of exiting the current state given that a transition has not already occurred. This rate is the dependent variable and, although not directly observable, it is regressed on the covariates and thus permits an estimate of the covariate influence (Blossfeld et al., 1989). For these data, more specifically, it provides an estimate of the influence of each covariate on the immediate likelihood of leaving the negative-affect state. A parametric model (e.g., Weibull) was not used to estimate the coefficients because the purpose of the investigation was to determine the direction of covariate influence and not to examine the form of duration dependency (see Allison, 1984; Vuchinich et al., 1991).

All event history models were generated using the Cox proportional hazards model (Cox, 1972; Cox & Oakes, 1984). Consistent with the assumptions of the Cox model, covariates in each husband and wife model were tested for proportionality (Appendix A). Log-likelihood estimates were generated with the partial likelihood (PL) estimation procedure. The PL provides a regression coefficient estimate for each covariate similar to the estimate provided in ordinary least squares regression. The ratio of this coefficient estimate to its standard error is a standardized t. If the value of this ratio exceeds 1.96, the covariate is statistically significant ($p < .05$) and indicates an influence on the hazard rate. Analogous to linear regression, a positive regression coefficient indicates that as the covariate increases the hazard increases; an increase in hazard denotes a decrease in state duration. Conversely, a negative regression coefficient indicates that as the covariate increases the hazard decreases, and the state duration lengthens. An estimate of the degree of covariate influence, specified as the percentage of change in the hazard rate per 1-unit change in the covariate, is obtained by subtracting 1 from the exponentiated regression coefficient multiplied by 100, or $\exp(\beta)-1 * 100 = \%$ change (Blossfeld et al., 1989; Griffin, 1993). All analyses were done using SURVREG (Preston & Clarkson, 1983), a microcomputer-based event history analysis program.

Results

Before developing separate models for husbands and wives, an initial event history analysis was run with gender as the only covariate. As expected, gender had a significant influence on the hazard rate ($t = 2.20$, $p < .05$). More specifically, wives had fewer but longer spells of negative affect (median = 16.2 s, $N = 212$) relative to husbands (median = 12.58 s, $N = 265$). Stated differently, wives had a lower hazard rate. Although wives had 53 fewer episodes, their total time in negative affect was 2.86 min longer than their husbands. Median values are reported because of skewness of the distribution.

A separate analysis by Task indicated that this gender difference in the hazard was not significant during the positive task ($t = 1.45$, ns), although wives still had longer spells in the negative state (median = 10.10 s, $n = 85$) than husbands (median = 8.16 s, $n = 90$). On the other hand, gender had a significant impact on the hazard rate during the negative task ($t = 2.17$, $p < .05$). Although husbands doubled the frequency of negative states ($n = 175$) and doubled their median duration (17.15 s), wives also doubled their median duration (20.95) and yet increased their frequency only by 50% (85 to 127). In effect, task affected the frequency of negative events more for husbands than wives, but husbands still tended to spend less time in the negative state irrespective of task. This gender difference is shown by comparing the respective survivor functions for the negative task (Figure 1). The survivor function represents the probability that an individual will remain in the negative state (survives) until the next immediate time interval given that a transition has not

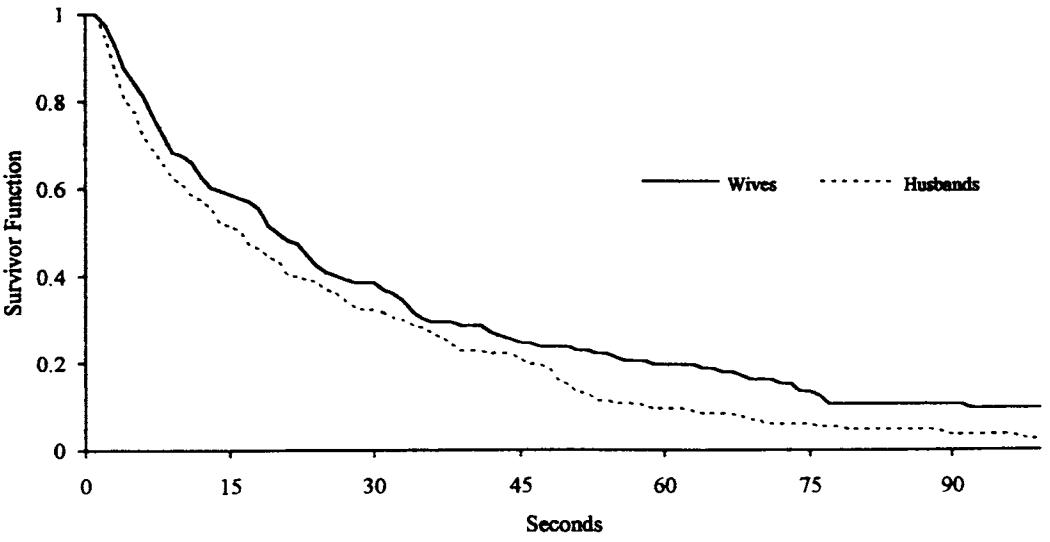

Figure 1. Survivor function by gender during negative task.

yet occurred. As seen in Figure 1, although the shape of the curves are similar, the husbands' curve is always below the wives', implying that husbands are continuously at higher risk of immediately transitioning from negative affect. Note also that these data were extracted from a larger composite of negative, neutral, and positive states; therefore, fewer negative episodes by wives do not necessarily imply that the average duration in state should be longer; wives might, for example, have shorter neutral episodes relative to the husbands.

Wife Model

Among the covariates in the model, only Tally was found to be nonproportional ($t = 2.43$, $p < .05$) and was used as a stratification variable in the final model. In this model, Tally was stratified over 10 levels: Level 1 equaled zero previous events, and Level 10 represented nine or more previous events. Among the six significant variables, five decreased the hazard rate (negative β); that is, an increase in Time in Task, Task, Ac.f. 1, Education, or Communication increased the time spent in negative affect (Table 1). This implies, for example, that wives were slower to leave negative affect during the negative task compared with the positive task, wives who devalue the role of communication in the relationship stayed longer in negative affect, and wives with higher educations stayed in the negative state longer.

By examining the percentage of change column in Table 1, it is apparent that the effect of Time in Task was minimal and Communication had a moderate effect, but the other three variables had a substantial influence on the hazard rate. For example, for each unit increase in Ac.f. 1, the hazard was reduced by 90%. This finding suggests that duration consistency across spells was associated with a propensity to stay in the negative state. Similarly, for each additional year of education, the hazard rate was reduced by 18%. Interpretation for Task, a dummy variable, is different than for the continuous variables. The estimate of percentage change is exp(−.5390) = .58. This implies that the hazard rate for wives exiting negative affect during the negative task was about 58% of the hazard rate of wives during the positive task. Viewed differently, the hazard rate for exiting negative affect was 72% (1/.58 = 1.72) larger in the positive-interaction task than in the negative-interaction task.

Only one covariate had a positive regression coefficient. Marital Satisfaction, as expected, moderately increased the hazard; that is, happily married wives were quicker to exit the negative state. Each additional point on the MAT increased the hazard rate by 2%.

Table 1
Regression Coefficients for Wife Transitioning From Negative Affect: Stratification by Tally (1–10), n = 212

Variable	β	*SE*	Standard *t*	≈% change[a]
Previous Duration	.0017	.0028	0.60	
Previous State	.2561	.1438	1.78	
Time in Task	−.0019	.0006	−3.16*	−.2
Task (D)	−.5390	.1751	−3.08*	58
Marital Length	.0030	.0015	1.90	
Spouse Rating	.0372	.0709	0.52	
Ac.f. 1	−2.3353	.7496	−3.11*	−90
Marital Satisfaction	.0190	.0053	3.58*	2
Education	−.1970	.0624	−3.15*	−18
Communication	−.0382	.0136	−2.81*	−1
Log-likelihood	−435.00			

Note. D = dummy coding: 0 = positive, 1 = negative; Ac.f. 1 = Autocorrelation Function Lag 1.
[a] Indicates the approximate percentage of change in the hazard rate for a 1-unit change in the explanatory variable; for Task (D), it is the relative hazard for negative task compared with positive task.
* $p < .01$.

Husband Model

Initial analyses indicated that four covariates did not meet the assumption of proportionality: Previous State, Marital Satisfaction, Education, and Communication Orientation. A series of models were run in which each nonproportional variable was used as a stratification variable, whereas the three remaining variables were entered as time-dependent covariates. Time-dependent covariates were entered in the model as interaction terms with time (specifically, $\log_e$ time) representing duration in negative affect (Blossfeld et al., 1989; Appendix A). The single best model (comparing log-likelihood estimates) was with Previous State (neutral, positive) as the stratification variable. Results from this model can be seen in Table 2.

Among the significant covariates, two were time-dependent—Marital Satisfaction × *Ln*(time) and Education × *Ln*(time)—and two were not—Task and Education. For husbands, like wives, the hazard rate was lower during the negative-interaction task. Exponentiating the coefficient for this dichotomous variable (β = −.561) yields .57, indicating that the hazard rate for exiting negative affect during the negative interaction was approximately 57% of the hazard rate during positive interaction. For Education, the coefficient was positive, indicating that education increased the hazard rate and shortened durations in negative affect. Aside from Task, this was the most powerful factor in the final model; each additional year of education increased the hazard by about 15%. Recall that education had a similar, yet inverse, impact on wives.

Interpretation of time-dependent covariates is more difficult. Although marital satisfaction was not significant as a main effect, the negative valence of Marital Satisfaction × *Ln*(time) suggests that the influence of marital satisfaction on the hazard decreases with time. However, given that the main effect was not significant and that the impact of the interaction term was minimal (−1% change), then the meaningfulness of this factor on the hazard rate should not be overemphasized.

On the other hand, the Education main effect was significant as was its interaction term. The interpretation would be that as Education increases the immediate likelihood of exiting negative affect increases (shorter durations), and this influence increases over time. In other words, the longer the negative affect state has existed, the greater the effect of education on the likelihood of immediately leaving the negative state.

Recall that having a nonproportional covariate means that the effect of the covariate on the hazard depends on the level of the covariate and duration and that this relationship changes over time. What does it indicate when husbands have several covariates that are dependent on time? Graphical examination of the natural log of the cumulative hazard rate for these stratified covariates suggests that, with the exception of Edu-

Table 2
Regression Coefficients for Husband Transitioning From Negative Affect: Stratification by Previous State (Neutral, Positive), n = 265

Variable	β	*SE*	Standard *t*	≈% change[a]
Previous Duration	−.0031	.0038	−0.81	
Time in Task	.0004	.0004	0.88	
Task (D)	−.5616	.1870	−3.00*	57
Marital Length	.0003	.0010	0.38	
Spouse Rating	.0506	.0653	0.77	
Tally	−.0276	.0277	−0.99	
Ac.f. 1	.5497	.5167	1.06	
Marital Satisfaction	−.0040	.0036	−1.10	
Marital Satisfaction × *Ln*(Time)	−.0102	.0028	−3.64*	−1
Education	.1374	.0449	3.06*	15
Education × *Ln*(Time)	.0764	.0263	2.90*	8
Communication	.0020	.0120	0.17	
Communication × *Ln*(Time)	.0139	.0080	1.72	
Log-likelihood	−986.72			

Note. D = dummy coding: 0 = positive, 1 = negative; Ac.f. 1 = Autocorrelation Function at Lag 1.
[a] Indicates the approximate percentage of change in the hazard rate for a 1-unit change in the explanatory variable; for Task (D), it is the relative hazard for negative task compared with positive task.
* $p < .01$.

cation, different covariate levels initially produced separate hazard rates but that the respective rates tended to converge rapidly over time (see Appendix B for an explanation of cumulative hazard). For example, the stratification variable Previous State showed initial hazard rate differences depending on whether the previous state was positive or negative; however, at approximately 15 s their rates converged (Figure 2). Notice that in Figure 2 the initial estimate for the cumulative hazard for Neutral Previous State was higher than for Positive Previous State, indicating that a larger proportion of husbands left negative affect quicker if the previous state was neutral. As Positive Previous State continues to rise, it eventually meets the level for Neutral Previous State. This suggests that the hazard rates for husbands coming from

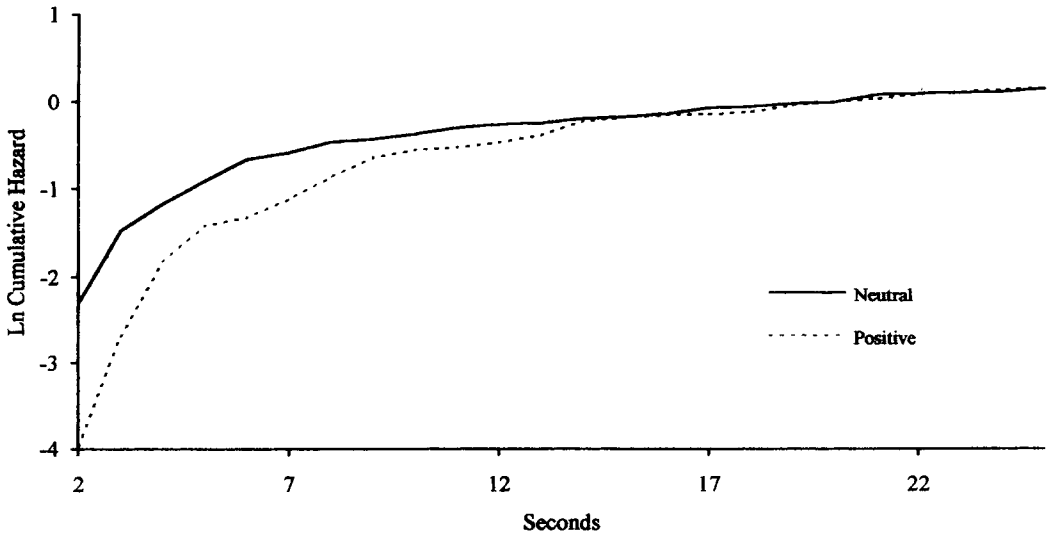

Figure 2. Log-minus-log plot of Previous State for husbands.

positive affect slowed only moderately over time, whereas hazard rates slowed much more rapidly for those coming from neutral affect; thus, the curves converge.

Gender Comparison

Table 3 presents an overview of findings by gender. Because of nonproportionality and time-varying covariates, each gender model was slightly different. However, significance and valence differences across the common covariates warrant a comparison. First, only four of the nine (44%) comparable variables in Tables 1 and 2 had coefficients in the same direction. Only Task and Education were statistically significant for both husbands and wives; yet for Education, the covariate influence was opposite across gender. For husbands, education increased the hazard, especially over time in state; conversely, wives with higher educations tended to exit the negative-affect state at a slower pace.

Second, in the husbands' model, covariates were more affected by time in state than in the wives' model. Specifically, husbands had four nonproportional covariates, indicating a change in the influence of the covariate across time. In the final model, two of three Covariate × Time interaction terms were significant. This suggests that, in general, time in negative affect modified the covariate influence for husbands more than for wives.

Table 3
Covariate Effects Across Husband and Wife Models

Covariate	Model	
	Husband (n = 265)	Wife (n = 212)
Task	Negative*	Negative*
Communication		Negative*
Time in Task		Negative*
Ac.f. 1		Negative*
Marital Satisfaction		Positive*
Education	Positive*	Negative*
Education × Time[a]	Positive*	
Marital Satisfaction ×Time[a]	Negative*	
Log-likelihood	−986.72	−435.00

Note. Ac.f. 1 = Autocorrelation Function Lag 1.
[a] Covariate was not in the model for wives.
* $p < .01$.

Third, the wife model fit the data better than did the husband model. Looking at the log-likelihood relative to the sample size provides a comparative estimate of how well each model fits the data; a smaller log-likelihood suggests a better fit to the observed data. As can been from Table 3, the husbands' log-likelihood value, using 13 covariates, is at least twice the wives' log-likelihood value using only 10 covariates; yet the husband sample was only approximately 25% greater.

Discussion

Interpretation of these findings must be examined within the framework of the dependent variable: the immediate propensity to leave negative affect. Negative affect as defined, analyzed, and interpreted in this study reflects the self-report of an internal state. These data require subject affect self-awareness and recall, both of these features differ from data usually used to describe marital interaction. In these data, the rater is asked to comment on affect occurring minutes earlier without reference to whether he or she was a speaker or a listener. It is not known whether exiting (or maintaining) a negative state results from what is being said by the rater relative to a relationship position (e.g., defending or explaining), what was being said by the spouse, what was being attributed to what was being said by the spouse (Fincham, Bradbury, & Scott, 1991), or some other cognitive or contextual filtering mechanism. We assume the affect rating is largely a response to cognitive attributions of observed spousal behaviors or specific comments relative to important marital issues, both proximal and distal. Because of the constraints of present technology, investigators can only assume that reported affect is a proxy to the internal state.

At present, our knowledge of marital interaction is defined primarily by overt behaviors (i.e., sequential patterns of discrete observable behaviors). The present data are fundamentally different; they represent the continuous movement of self-report internal states. Should there be convergence between these data sources? If so, what findings in the literature complement the current results? The remaining discussion attempts to discuss the present results within the context of current literature.

First, consistent with the Gottman-Levenson model (1986, 1988), wives maintained negative

affect longer than their spouses. This gender difference was especially evident during the negative task. Although these findings appear consistent with existing literature (see Weiss & Heyman, 1990), there is a fundamental difference. Existing literature has its basis in proportion or frequency of negative verbals or nonverbals that wives, especially distressed ones, express during a laboratory task (Noller, 1984; Sade & Notarius, 1985). It is surprising that in these data there were fewer visits to negative affect by wives. Existing observational data suggest that wives, relative to their husbands, enter and exit negative affect more often; these self-report data indicate the reverse. A possible explanation is that wives may appear to go from negative to nonnegative during any particular interaction sequence; yet their internal state may remain negative. In other words, in observation data a wife's negative → neutral → negative three-turn sequence suggests that the wife left the negative state for some undetermined period between the negatives; these data leave open the possibility that she may have remained in negative affect throughout the sequence. Such a discrepancy has at least two implications. First, nonnegative observational codes may not accurately reflect the internal state; thus, a validity issue arises. Second, observational data may underestimate the amount of negative affect experienced by wives during laboratory tasks. In effect, current literature suggests that wives visit negative affect more often than husbands. This may be a methodological artifact. They may not be visiting more often but merely staying continuously in the state while exhibiting behavior coded as nonnegative. Next, wives seemed to be influenced by a very different set of factors than their husbands. Most notably, their general impression of the marriage influenced their likelihood of leaving negative affect. For example, more happily married wives tended to leave negative affect faster, and wives who saw little utility in discussing problems tended to leave negative affect slower. On the other hand, neither Marital Satisfaction or Communication influenced the hazard rate for husbands. However, it is interesting to note that these variables plus Education showed an interaction with duration for husbands. Although speculative, such behavior suggests that husbands are sensitive (i.e., reactive) to how long they have been in negative affect. In turn, as the stay in negative affect lengthens, their immediate likelihood of exiting depends less on the influence of the covariate and more on time in state. This propensity is illustrated graphically in Figure 2.

In some respects, this interpretation is consistent with existing literature on the behavior of husbands. For example, Gottman, Levenson, and others (Notarius et al., 1989; Gottman & Levenson, 1986, 1988; Schaap, 1984) suggested that, throughout an interaction, husbands will attempt to stop conflict, possibly because of its aversive physiological effect. Although these analyses could not determine the husbands' behavioral attempts to stop conflict, they do suggest covariate sensitivity to time in state. Given that husbands' hazard rates were not affected by the global measures of marital satisfaction or communication orientation or sensitivity to task duration, it could be speculated that husbands, while in a negative affect state, operate from a moment-by-moment perspective. In general, the pattern of covariate influence suggests that husbands react to the situation, whereas wives react to the relationship. Of course, additional work is needed to support or refute this position.

As noted, few covariates influenced the husband hazard rate, but the wives had several that warrant additional comment. For example, Ac.f. 1 was associated with a lower hazard. This means that wives who had duration consistency across episodes also tended to have longer durations. Stated differently, duration variability was associated with shorter durations. Duration consistency should not be confused with sequential pattern rigidity, which has been associated with marital distress (Schaap, 1984). In the observational literature, pattern rigidity usually refers to negative reciprocity, especially by distressed wives (Schaap, 1984; Weiss & Heyman, 1990). In these data, rigidity refers to the likelihood that the current duration can be predicted, in part, by knowledge of previous durations. It seems that, at least in these data, the greater the degree of predictability, the greater the likelihood of staying in negative affect. An initial guess might be that duration rigidity reflects marital dissatisfaction; however, among the wives, in these data Marital Satisfaction and Ac.f. 1 were nonsignificantly positively correlated ($r = .41$, *ns*, $N = 19$). Unfortunately, the sample size and restricted range of

marital distress precluded an additional separate analysis, splitting the sample by gender and distress level.

It is interesting to note that this finding of temporal predictability is consistent with results reported by Roberts and Krokoff (1990). Similar to the present analysis, Roberts and Krokoff examined the temporal parameters of dyadic interaction and found that satisfied couples were highly patterned for specific husband and wive negative-affect exchanges. Such rigidity is usually associated with marital distress. The current findings, although similar, are not directly comparable because the present data involve intrasubject predictability rather than the couple temporal predictability examined by Roberts and Krokoff. Nonetheless, such findings are contrary to current literature and suggest that additional work is necessary to determine whether these findings are an artifact of the type of analyses used or whether predictability associated with marital distress varies as a function of sequence versus temporal variables.

The largest discrepancy between men and women in the data was the influence of education. Education had a powerful, yet inverse, effect on the hazard rate for husbands and wives. Wives with greater education tended to stay in negative affect longer, whereas husbands with higher educations were quicker to leave negative affect. Numerous survey studies included education as a covariate in attempting to predict marital satisfaction only to find that it did not have an effect (Glenn & Weaver, 1978). However, its moment-to-moment influence on marital interaction has not been examined in part because the data-analytic strategies used with observational data (e.g., sequential analysis) do not readily permit inclusion of multiple covariates. As a result, there was little information in the literature about husbands on which to interpret the results, and given the sample characteristics (small samples, well educated), it is probably preferable to wait for a replication.

On the other hand, the wives' rating pattern is strikingly similar to findings by Krokoff et al. (1988), who found a difference in wives' negative-affect expressivity as a function of occupational status. Although in their sample group composition was determined by occupational status, white-collar wives did have a much higher education level and, like the wives in this sample, they too were more willing to express negative affect. Krokoff et al. (1988) speculated that social standing (education, occupational opportunities) may provide these wives with a stronger power base within the relationship, and thus they would be less inclined to inhibit the expression of negative affect during an interaction. This seems to be a reasonable explanation given their measure of codable overt negativity, but what about a similar finding for the self-report of an internal state? Does this imply correspondence between an internal state and the expression of that state? More specifically, for example, if a highly educated wife feels confident enough to overtly express negative affect during an interaction with less fear of the consequences to the marriage, than, say a lower educated, less economically secure wife, should this same highly educated wife also report more negative affect? Because of perceived resources, it may be possible that well-educated wives believe they have the privilege of maintaining feelings of negativity longer relative to those wives with less resources (e.g., less education). Does this privilege of internally maintaining a specific affect differ from the overt expression of that same affect? Because these data were not coded for negative affect but rather depended on self-report, these questions are not answerable. Yet it does provide a general framework for a future study examining the correspondence between a reported affect and its external expression and determining whether the correspondence varies by covariate level.

These findings should be considered the first step in developing a more comprehensive stochastic model of the processes that describe the temporal parameters of emotional states during marital interaction. Gender differences are evident. As noted, these results are consistent with existing literature in some areas, and in other areas they differ. Because of the importance of negative affect, it was the focus of the present analysis. Additional analyses of transitions across all affect states are needed to provide temporal indexes of marital interaction that can be combined with existing sequential pattern data to develop a comprehensive and valid theory of marital quality. Although these results provide some support for gender differences, at least cross-sectionally, generalizability is limited until these findings are replicated with a larger, more distressed sample.

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(*Appendixes follow on next page*)

Appendix A

Estimation of Proportionality in the Cox Model

Because of the factorization (i.e., the estimation procedure is divided into two factors; one estimates the influence of the covariates and the other estimates, yet ignores, the shape of duration dependency) used to obtain the hazard, an assumption underlying this model is that, for any two individuals at any point in time, the ratio of their hazards is a constant, or proportional. Although this model is somewhat robust to the violation of this assumption, it is preferable to stratify the nonproportional variable to estimate the best model (see Blossfeld et al., 1989). By stratifying, the semiparametric model permits a general estimate of the covariate influence across different levels of the covariate, but the baseline hazard is allowed to vary and yet remain unspecified (Cox & Oakes, 1984). To determine proportionality, an interaction term is created by multiplying the covariate with duration or *Ln*(duration) and is included in the initial model without stratification. If this interaction term is significant, then a new model is specified using the covariate as a stratification variable; if another covariate is being used as the stratification variable, the interaction term is included in the general model. For these analyses, the interaction terms were generated using the following: covariate * [*Ln*(duration) − *ln*(average duration of negative state)]. (See Blossfeld et al., 1989; Griffin, 1993; Yamaguchi, 1991.)

Appendix B

Estimation of Cumulative Hazard

The cumulative hazard rate represents the hazard rate integrated over time. It provides a good visual impression, by means of the curve slope, of the rate of exitings over specific time intervals (Kalbfleisch & Prentice, 1980). It can be estimated by taking minus the $\log_e$ of the survivor function at each time interval—$-lnS(t)$. Although this initial value can be plotted, typically again $\log_e$ is taken—$ln - lnS(t)$—and plotted against time. In the literature, this is may be referred to as a log-minus-log plot or a log-minus-log survivor function plot (see Blossfeld et al., 1989; Kalbfleisch & Prentice, 1980). Most event history analysis programs provide this plot; if not, it can be estimated using the survivor function or a nonparametric substitute (i.e., Kaplan-Meier estimate; Kaplan-Meier, 1958). Both estimates are routinely generated as part of the output of event history analysis programs. Curves used in Figure 2 were generated using $ln - lnS(t)$ versus time.

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