Assessing the Role of Emotion in Marriage

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This article reviews recent research in the area of marital interaction. It suggests that sufficient consistency exists in the observational results to begin theory construction to explain three basic patterns. Theory construction is then described that is designed to assess the role that emotional expression and control play in accounting for variation in marital satisfaction. Next the argument is made that the key to the assessment of emotion is specificity, and a case is made for a dialectic between specific features and cultural informants coding systems. On the basis of this discussion, the role of the autonomic nervous system is discussed in the construction of a sociophysiological theory of marriage.

The scientific study of marriage essentially was the exclusive province of sociologists until about 1973, when psychologists began employing observational methods to systematically study marital interaction. The sociological tradition, initiated by Terman and colleagues (Terman, Buttenweiser, Ferguson, Johnson, & Wilson, 1938), had never employed observational techniques, choosing rather to utilize subjects' self-reports. What emerged from this sociological research was a number of self-report measures of marital satisfaction. When first perusing these measures (e.g., Locke & Wallace, 1959), it is easy to think that they would be weak and subject to all sorts of bias. However, the opposite seems to be true; these measures have been demonstrated to have high levels of construct, discriminant, concurrent, and predictive validity. As the number of different

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measures proliferated, and as high levels of intermeasure correlations were found (usually in the range of .80-.90), there were calls for the use of a common terminology for all marital questionnaires (see Burgess, Locke, & Thomes, 1971). High correlations among measures still are the rule; for example, the Spanier scale (Spanier, 1976) correlates .83 with the Locke-Wallace scale. No doubt one source of these high correlations is the similarity of items that are found on the different scales. But beyond this, it seems that unhappy couples will endorse almost any negative item, and happy couples will endorse almost any positive item about their marriage. If a study includes couples with a wide enough range of marital satisfaction levels, high correlations can be expected across different measures of marital satisfaction.

Although sociologists rarely studied couples engaged in the process of making decisions and reaching agreements directly, an emergent theme in their research was the importance of consensual processes in marriage. Variables that tapped consensual dimensions of marriage consistently accounted for variation in marital satisfaction. For example, a demographic variable such as income might be unrelated to marital satisfaction, but the perception of the adequacy of the income would be related to marital satisfaction. Despite all of the problems of common method variance and multi-collinearity that plagued this kind of questionnaire-based research, it provided some good clues as to where to look to find behavioral differences between satisfied and dissatisfied marriages. Since items that required spousal consensus were the best predictors of marital satisfaction, it suggested that the first place to look for differences in observable behavior would be where couples were attempting to reach consensus and agreement. Thus, when psychologists began to study marriage, processes of conflict resolution came in for careful scrutiny.

It is interesting to note that, even in its early heyday, observational methodology in psychology included the study of marriage. Barker's (1963) classic book, *The stream of behavior,* included a chapter by Soskin and John, which analyzed the interaction of a married couple on vacation. The couple wore backpacks with wireless transmitters that broadcast their every word (16-hours a day) to a receiving station. Although these researchers knew very little about what to examine in marital interaction, the study is a fascinating piece of scientific history. By 1973, a body of observational research on marriage began appearing in print. The first observational systems were very crude, particularly in their assessment of nonverbal behavior and emotion. In the ensuing decade, we have made considerable progress in making these kinds of assessments, and in developing methods for generating samples of marital interaction to observe.

OBSERVATION OF MARITAL INTERACTION

The major research question in the early observational studies of marriage was the same question posed by Terman, namely, how are satisfied and dissatisfied marriages fundamentally different? There were serious

problems in the way this question was pursued, but the fact that systematic observation was employed at all turned out to be a major contribution of psychologists in the historical development of marriage research.

One serious problem in this early research was the kind of tasks used to generate marital interaction. Often the task did not produce comparable kinds of behavior in both satisfied and dissatisfied couples. This is an important, but easily overlooked point; a task producing *qualitatively* different kinds of behavior in the two groups of couples greatly limits the basis for comparison. If the goal were only to discriminate satisfied from dissatisfied couples, then this would not be a problem. But if the goal is to discover fundamental behavioral differences between satisfied and dissatisfied couples, then both kinds of couples would need to exhibit the same kinds of general behaviors within which the fundamental differences were to be found.

To illustrate this point, consider the hypothesis that satisfied and dissatisfied couples differ in the way they resolve conflict. Unfortunately the interaction tasks used in most of the early investigations did not induce much conflict in *satisfied* couples; they only induced conflict in *dissatisfied* couples. For example, Olson's Inventory of Marital Conflict (Olson & Ryder, 1970) provides the husband and wife with two sides of a *fictional* marital dispute, with the instruction to decide which of the fictional parties is most at fault. Our work with this task (Gottman et al., 1976) revealed that while it does induce conflict in dissatisfied couples, it does *not* induce conflict in satisfied couples (most satisfied couples make fun of it). Again, if the goal is solely to discriminate satisfied from dissatisfied couples, then this task is quite adequate. But if the goal is to understand how the two groups of couples differ in resolving conflict, the Inventory of Marital Conflict will be inadequate because it does not produce comparable behavior (i.e., conflict) in both groups. The same problem exists for Raush, Barry, Hertel and Swain's (1974) improvised conflict situations. With Raush's permission, Gottman (1979) was able to recode and reanalyze Raush et al.'s (1974) tapes; as with the Inventory of Marital Conflict, conflict was only induced in dissatisfied couples.

To deal with the problem of task selection, Gottman (1979) empirically derived two tasks that produce conflict in both satisfied and dissatisfied couples. One task was derived by interviewing 60 couples and identifying those situations such as in-laws, sex, and money that induced conflict in both satisfied and dissatisfied couples. This led to a set of "generic" conflicts that could be improvised or role played by both satisfied and dissatisfied couples. The second task was more "marriage specific." Here, each couple completed a problem inventory on which they rated the severity and duration of a number of problem areas in their marriage. The couple was then interviewed to sharpen and focus the conflict area (the "play-by-play" interview; Gottman, 1979). After preparing the subjects by using the problem inventory and the play-by-play interview to isolate an existing area of disagreement, the couple was asked to try to resolve their disagreement. Although this procedure was not always suc-

cessful, in most couples it produced comparable samples of behavior that could be examined for specific differences in the way satisfied and dissatisfied couples resolve conflict.

For the past four years we have been using a third task in which couples talk about the events of their day after having been apart for at least eight hours. This task is not viewed as a conflict resolution task (although it does sometimes induce conflict in dissatisfied couples), but provides a format in which other kinds of interactive behaviors, such as planning, empathic listening, and support, information exchange, can be studied in both satisfied and dissatisfied couples. The interactions of both kinds of couples seem quite natural on this task.

Coding of Emotional Behavior During Marital Interaction

Previously we mentioned that the early attempts at observational description were quite crude, particularly in the extremely central area of describing emotion. This is understandable given that it is only in the past six years that we have had the basic tools for such essential tasks as measuring the anatomical basis of facial expressions of emotion (Ekman & Friesen, 1978). In this section, we discuss the methods used to code emotion. We caution the reader that some of these ideas depart from mainstream thinking about emotion: It is our thesis that emotional behavior during marital interaction needs to be coded in two different ways for two different purposes.

Coding Specific Affects

There are two approaches to coding emotions, which we will call *physical features* and *cultural informants*. The physical features approach tries to detect specific cues that are cross-culturally universal or at least reliably related to emotion in a given culture. The physical features identified are almost always *nonverbal*, and they are further subdivided into separate "channels" such as the face, the voice, gestures, paralinguistic features, and the autonomic nervous system. Often an attempt is made to isolate the channels further; for example, the content of the verbal channel may be removed by the use of lowpass filtering or random splicing so that the acoustic properties of the voice can be coded independently of the speech content. In contrast, the cultural informants approach is based on *emotion judgments* made by people judged to be competent readers of emotion in a particular culture. Usually these emotion judgments are based on an integration of various channels of information. We will briefly discuss each approach.

Specific Features. In the past decade a great deal of progress has been made in identifying specific nonverbal behaviors that are good predictors

of emotion, including specific features in the voice that convey affective information. Unpleasant stimulation leads to constriction of the pharynx and the vocal pillars. Changes in vocal shape can be measured reliably from the glottal spectrum. For example, a chest register voice is deep, resonant and relaxed, whereas a head register is tense, perhaps indicative of emotion or emotional control. The fundamental frequency and its shifts to higher levels gives reliable affective information (for a review, see Scherer & Ekman, 1982). Speech disturbances are also indicators of emotion (for a review, see Harper, Wiens, & Matarazzo, 1978).

Until six years ago, reliable, objective measurement of the face was not possible. Two major methods now exist, electromyography and Ekman and Friesen's (1978) Facial Action Coding System. The Facial Action Coding System (FACS) is an anatomically based system for measuring visible facial movements; electromyography (EMG) can measure nonvisible changes in facial muscles, but it is more obtrusive and less precise in pinpointing which facial muscles have contracted. Nonetheless, both methods have been validated (for a review, see Davidson, 1984). Empirical support for the emotional meaning of various facial configurations continues to accumulate. For example, Ekman and Freisen (1982) have described the "unfelt smile", which consists of contraction of the zygomatic major muscle (pulls the lip corners up) with no involvement of orbicularis oculi (muscle around the eye).

Cultural Informants. Despite the importance of discoveries of the past decade based on the specific physical features approach, it has three problems as a method of coding affect. First, it attempts to extract emotional information only from the *nonverbal* channels. This view has arisen to emphasize evolutionary continuity in emotion expression, undoubtedly inspired by the important work of Darwin (1872). However, this practice would be obviously mistaken if applied to marital interaction, as words contain a great potential for communicating emotional information. To illustrate this point, consider the following transcript of a marital interaction (H = husband; W = wife):

H: You'll never guess who I saw today. Frank Dugan!
W: So, big deal, you saw Frank Dugan.
H: Don't you remember I had that argument with him last week?
W: I forgot.
H: Yeah.
W: So I'm sorry I forgot, all right?
H: So it was a big deal to see him.
W: So what do you want me to do, jump up and down?
H: Well, how was your day, honey?
W: Oh brother, here we go again.
H: You don't have to look at me that way.
W: So what do you want me to do, put a paper bag over my head?

Considered by itself, the verbal content of this interaction has a number of indications that the couple was experiencing the emotion of anger. A great deal of emotional information would be lost if these indicators were ignored.

A second problem with the physical features approach is what might be called the "additive channel assumption" (Gottman, 1982), which assumes that specific features *add* emotional information to a substrate of "emotion neutral" language. Without such an assumption, techniques such as high frequency voice filtering would not make sense. However, it is easy to show that physical features *interact* with language to convey emotional meaning. For example, consider the paralinguistic cue of stress. If the word "soon" is stressed in "I'd like this as soon as possible," it conveys impatience; if the word "possible" is stressed it conveys the opposite. When speech is electronically filtered, reliability in emotion coding is probably obtained at the expense of coding most speech units as being emotionally neutral.

A third problem with this approach is that a great deal of emotional information is communicated in culturally *specific* ways. For example, Feld's (1982) research on the Kaluli noted that they use vestiges of specific tropical bird sounds to convey emotional meaning. A Kaluli will say, "my mother-in-law is coming to live with us" and use one bird-like sound to convey pleasure and another for sadness. Only a competent Kaluli informant would be able to detect this information. Because it is not cross-culturally universal does not imply that it is not useful emotional information.

Despite the fact that it is possible to identify specific cross-culturally universal features that communicate anger, this certainly does not mean that there is only a single way to be angry. We believe that emotion in the stream of natural social interaction is conveyed by a nonadditive gestalt of information, which is detectable by competent cultural informants. In practice it is wise to employ cultural informants who also have been trained to recognize the important physical features (e.g., can read the face using FACS), but who view them as but *examples* of how emotion may be expressed.

We believe that there are considerable scientific benefits to be obtained by maintaining a continual dialectic between the specific features approach and the cultural informants approach for coding emotion. We employ both methods in our work. We have developed a cultural informants method of coding specific affects and instances of emotional control (SPAFF) during marital interaction. We also utilize the physical features approach in two ways. After emotional moments that occur during interactions are identified and coded with SPAFF, the Facial Action Coding System is used to code any facial expressions that occur during that moment. In addition, we are currently using a more rapid version of the Facial Action Coding System that codes only those facial muscle contractions that are relevant to emotion (Ekman and Friesen's EMFACS). Using EMFACS in this manner enables us to obtain a *continuous* coding

of emotional facial expression, including those moments not identified by SPAFF (e.g., emotional facial expressions that function as silent listener responses).

THE GOAL OF THEORY CONSTRUCTION

Before turning to a description of the experiments we have conducted using these methods and the findings we have obtained, it might be useful to define some of our terms and to describe the overall goals of this endeavor.

We believe that there is a need to build a theory of marriage. The art in constructing a theory of marriage lies first in the identification of interesting and fundamental phenomena about marriage that need explanation. Of course, different investigators will differ in what they consider interesting and fundamental, but the phenomena to be explained should constitute a set of stable patterns. Once the phenomena are selected, theoretical questions naturally emerge, because we cannot help asking, "Why do these patterns occur? What explains this?" *Theory is the explanation of pattern.* Once theory is constructed, we will surely employ empirical standards to evaluate its predictions. But in addition, we should consider applying "aesthetic" criteria as well. Good theory ought to be very stimulating intellectually; it ought to have a range of application far wider than the original set of phenomena that were its parents; and it ought to be elegant. These aesthetic criteria are very subjective—one person's elegance can be another's ugliness—but they seem to us to be worthwhile goals.

CONSISTENT PATTERNS IN MARRIAGE

In terms of identifying consistent patterns, the first ten years of observational research on marriage have been quite encouraging. At the 1983 meeting of the Association for the Advancement of Behavior Therapy those of us who do observational research with couples met with an awareness that laboratories in California (G. Margolin), Oregon (R. Weiss; H. Hops), Washington (N. Jacobson), New Jersey (S. Ting-Toomey), Massachusetts (H. Raush), Washington, D.C. (C. Notarius), Colorado (H. Markman), Texas (J. Vincent), Holland (C. Schaap), Germany (K. Halweg, D. Revenstorf), and Australia (P. Noller) were observing similar differences between satisfied and dissatisfied couples. This was so despite wide variations in interactional tasks, recruitment procedures, ways of grouping couples and defining marital distress, and observational coding systems (for a review of the specific findings from these laboratories see Gottman, 1979; Schaap, 1982).

Three patterns can be identified as the most consistent across laboratories. First, there is more negative affect in dissatisfied couples than in satisfied couples. Findings concerning positive affect are much less consistent. Second, there is greater reciprocity of negative affect in dissatisfied

couples than in satisfied couples. This means that sequential analyses of the stream of behavior reveal that if one spouse expresses negative affect, the other spouse is more likely to respond with negative affect in a dissatisfied marriage than in a satisfied one. Third, the interactions of dissatisfied couples show a higher degree of structure, more predictability of one spouse's behaviors from those of the other, and less statistical independence than is found in the interactions of satisfied couples (see Gottman, 1979, for a review of evidence for greater temporal predictability in the interactions of dissatisfied couples). These patterns account for about 30 percent of the variance in marital satisfaction across laboratories, and this is more predictable variance than that found in the sociological studies using questionnaires. Further, the observational studies do not suffer from the problem of common method variance that has plagued the questionnaire studies.

STUDIES OF AFFECT AND PHYSIOLOGY DURING MARITAL INTERACTION

The three patterns described in the previous section were the phenomena that we set out to explain in our first collaborative study of marital interaction in 1980. In our early thinking we emphasised negative affect. This emphasis had multiple sources. Positive affect and positive affect reciprocity had not proven to be very useful in discriminating satisfied from dissatisfied marriages (e.g., Gottman, 1979). In addition, greater cross-situational consistency in marital behavior had been found for measures of negative affect and negative affect reciprocity than for measures of positive affect (Gottman, 1980). And finally, we expected that our autonomic nervous system measures would be primarily responsive to the negative emotions such as anger and fear, by virtue of the role the sympathetic nervous system plays in preparing the organism to deal with emergency situations (e.g., those requiring fighting or fleeing).

The Initial Marital Interaction Study

When we first embarked on this collaboration, we were both interested in studying emotion. Ekman, Friesen and Ellsworth's (1972) classic book *Emotion in the human face* had suggested social interaction as an important context for studying emotion, but most investigators in the field were still using single subject paradigms. As described above, we were particularly interested in marital dissatisfaction, especially in relationship to negative affect, negative affect reciprocity, and automonic nervous system activation. It was also clearly the case that we saw this collaboration as an opportunity to collect a marvelous and unique multi-measure, multi-method data base that could be explored in a number of different ways.

Our first study was run in 1980 (Levenson & Gottman, 1983). Thirty couples came to the laboratory at the end of the day after at least eight hours of separation and had two conversations. The first was a relatively

low-conflict discussion in which they discussed the events of their day, and the second was a high-conflict discussion in which they attempted to resolve an issue in their marriage that had been a major source of disagreement for both spouses (the problem inventory and play-by-play interview procedures described above were used to facilitate this interaction). Each spouse returned to the laboratory on a separate occasion to view the videotape of these interactions and to provide a continuous self-rating of his or her own affect on a rating dial that utilized a "positive-neutral-negative" scale. During both sessions we measured four physiological variables: heart rate, pulse transit time to the finger, skin conductance, and general somatic activity. All physiological, self-report, and video data were synchronized to the same time base (for full details on these procedures, see Levenson & Gottman, 1983).

The interactions that occurred in this study were powerful, emotional, and generally unconstrained. Questions of generalizability can be raised about any laboratory procedure, but much to our relief, the interactions seemed quite natural and quite real. Previous work comparing marital interaction in the laboratory with marital interaction at home had indicated that differences between satisfied and dissatisfied couples observed in the laboratory *underestimate* those that would be obtained from home recordings without an observer present (Gottman, 1979). The naturalness of the interactions, coupled with this tendency to underestimate differences, gave us a degree of confidence in the generalizability of the findings that emerged from our analyses.

The data base we collected in this study allowed us to ask a number of questions. We began by exploring ways in which the interactions of satisfied and dissatisfied couples differed. Two kinds of differences emerged. First, as in previous research, marital dissatisfaction was associated with higher levels of negative affect and negative affect reciprocity. Second, we began to explore the notion that the interactions of dissatisfied couples would not only be characterized by reciprocity of negative affect, but also by a kind of temporal predictability and reciprocity in physiology as well. "Physiological linkage" was the term we used to describe this hypothesized physiological marker of marital dissatisfaction.

The notion of physiological linkage had been implied by the results of the small study by Kaplan, Burch and Bloom (1964). They paired people on the basis of sociometric measures of mutual like, dislike, and neutrality and found that predictability from one person's galvanic skin response (GSR) to another's only existed for people who *disliked* one another. It seemed reasonable to expect that dyads that disliked each other would express greater amounts of negative affect, and that it was this negative affect that was activating the GSR.

In the Kaplan et al. (1964) study, simple correlations were used to measure the extent of physiological relatedness between people. There are serious problems with this statistical approach because physiological data can be highly autocorrelated (i.e., cyclical). Nonetheless, in our study, when we used a more appropriate time-series analysis to assess

predictability from one spouse to the other (controlling for autocorrelation), we found that the conclusion of Kaplan et al. held. In fact, we were able to account for 60% of the variance in marital satisfaction with our physiological linkage variables.

We found evidence for the relationship between physiological linkage and marital satisfaction only for the high-conflict problem solving discussion. We still do not completely understand the linkage variable, but we think it reflects the autonomic nervous system concomitants of cycles of negative emotional activation and deactivation, which are particularly prevalent in the problem solving conversations of dissatisfied couples. As evidence has continued to accumulate that different negative emotions have different patterns of autonomic nervous system activation (e.g., Ekman, Levenson, & Friesen, 1983), it seems likely that a fuller understanding of physiological linkage will require the consideration of which specific negative affects are being exchanged between spouses, and which specific autonomic nervous system variables are becoming linked.[1]

Validity Of The Self-Report Of Affect Procedures

In the previous section our procedure for obtaining subjects' self-reports of affect was described. This procedure involved having spouses return separately to the laboratory for a video recall session in which they viewed the videotapes of their interactions and provided a continuous affect rating using a rating dial. We developed this procedure as a way of obtaining a continuous rating of affect without interrupting the flow of the conversation to obtain affect ratings. The need for a continuous measure reflected our belief that emotions change very rapidly during a marital interaction, that these rapid changes are important for detecting emotional patterns in the interaction, and that typical procedures such as administering a single mood scale at the end of the interaction are not adequate for these purposes. Nonetheless, the question remained whether the video recall and rating dial procedures we adopted were valid.

To assess the validity of this self-report of affect procedure, we devised five tests. The first three were straightforward. First, the measure should be able to discriminate between high conflict and low conflict interactions. Second, the measure should be able to discriminate between satisfied and dissatisfied couples. Third, spouses' ratings of the same interaction should show evidence of statistical coherence. The forth test required agreement between the self-reports of affect and the ratings of objective coders (we used SPAFF to code all of the videotapes in terms of specific affects and then collapsed these ratings into positive and negative affect codes). The fifth and final test was designed to assess the power of the video recall procedure itself and was probably the most controversial. We reasoned that if subjects experienced the same sequence of emotions

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[1] In our original data set, with only 30 couples, we did not have an adequate sample size to explore this hypothesis. We have recently completed a new study of 79 couples that should be suitable for this more exacting level of analysis.

when viewing the videotapes as they had experienced during the actual interaction, then we should see indication of similar patterns of automonic nervous system activity in the video recall session as had occurred in the interaction session.

The self-report of affect procedure passed all five of these tests (see Gottman & Levenson, 1985, for a full reporting of these results). We think that one reason it passed the first four tests was because it passed the fifth test, which we have termed "physiological reliving." We assessed physiological reliving by computing the coherence between the interaction session and the video recall session for each of the 30 couples for each of the four physiological measures (e.g., interaction session heart rate vs recall session heart rate). This was carried out separately for the physiological responses of each spouse during each of the two interactions. Of these almost 500 comparisons, over 90% were statistically significant, indicating that the spouses could be said to be reliving the original physiological experience as they watched and rated the videotapes. There was approximately 35% shared variance in physiological responses between the interaction session and video recall session. Furthermore, not only were these two sets of responses strongly correlated, but the time series were usually in-phase. This means that when a spouse watched the tape of the interaction, sweating, changes in cardiovascular functioning, and changes in movement all occurred at the same times as they had occurred when he or she was in the actual interaction.

The Follow-up Study

In 1983, we completed a longitudinal follow-up study of the 30 couples who had participated in the 1980 study, successfully locating 21 of these couples and having them complete questionnaires concerning their current levels of marital satisfaction. We then computed a simple change score that indicated the amount and direction of change in marital satisfaction that had occurred between 1980 and 1983. Using partial correlations (to control for initial levels of marital satisfaction), we determined which of the affective and physiological variables measured in 1980 were predictive of changes in marital satisfaction that had occurred during the ensuing three years. Two strong findings emerged (see Levenson & Gottman, 1985, for a complete report of these findings). First, negative affect reciprocity was a strong predictor of change in relationship satisfaction. And second, physiological arousal (in all measures) was highly predictive of declines in levels of marital satisfaction. The sizes of these correlations were quite encouraging; for example, the correlation between the husband's heart rate during the conflict discussion and decline in marital satisfaction was .92.

We were stimulated by these findings and are currently analyzing data that focus in on specific emotions that occurred during these interactions. This work is driven by a dialectic: (a) we are interested in understanding marital relationships; and (b) we view marital interaction as a useful

context for carrying out basic research on emotion. In the remainder of this article we will highlight the research questions we are now studying, and present some new hypotheses that have been generated from the findings to date.

THE ANATOMY OF NEGATIVE AFFECT RECIPROCITY

What exactly are "negative affect" and "negative affect reciprocity"? When we use the term negative affect, it refers to the specific emotions of anger, contempt, disgust, sadness, fear, and to their blends. The question can be raised whether anything is gained in breaking down global affect categories (e.g., negative affect) into more specific emotion categories such as fear and anger. We believe that there is potentially a great deal to be gained. Table 1 illustrates the percentages of affect in three global categories (positive, negative, neutral) derived from the SPAFF coding of one couple during their high conflict discussion. As can be seen from the table, this couple is high in negative affect (over 80% of each spouse's affect is negative). The extent of the couple's negative affect reciprocity can be assessed by means of z scores (see Allison & Liker, 1982; Gottman, 1980). More precisely, the z scores indicate the reduction in uncertainty in predicting whether one spouse's affect will be negative that is gained by knowing that the antecedent affect on the part of the other spouse was negative; if the z is larger than 1.96 we can think of this as negative affect reciprocity (this is only true asymptotically). There are two z scores computed for a couple, one for predicting the wife's negative affect from the husband's ($z = 6.23$), the other for predicting the husband's negative affect from the wife's ($z = 6.95$). Since both z scores for this couple are greater than 6.0, there is evidence of highly significant negative affect reciprocity. The closeness of the two z indicates that the negative affect reciprocity is symmetrical; that is, the wife reciprocates the husband's negative affect and the husband reciprocates the wife's negative affect.

However, looking only at the global affective data in Table 1 could lead to the quite erroneous conclusion that the wife and the husband are expressing essentially the same emotions. Table 2 shows the percentages of specific negative affects expressed by each spouse (again derived from the SPAFF coding). As we can see, 77.7% of the husband's negative

TABLE 1
Percentages of Global Affects

Spouse	Affect		
	Neutral	Positive	Negative
Wife	5.7	5.7	88.6
Husband	10.5	5.3	84.2

TABLE 2
Percentages of Specific Negative Affects

Spouse	Affect				
	Anger	Contempt	Whining	Sadness	Fear
Wife	6.0	0.7	38.9	21.7	32.6
Husband	33.7	44.0	15.2	0.0	7.0

affect is anger and contempt, while only 6.7% of the wife's negative affect is anger and contempt. Most of her negative affect is whining, sadness, and fear (93.2%). Analysis of the z score indices of specific affect reciprocities (e.g., wife responds with fear to husband's anger) reveals a clear dominance structure, and an asymmetry in sequential structure. The result of these analyses is illustrated by the schematic state-transition diagram in Table 3. He reciprocates her anger, but she does not reciprocate his; instead she responds to his anger with fear, which leads back to his anger. The apparent symmetry derived from the analysis of global affects completely dissolves when the specific affects are examined.

TOWARD A SOCIOPHYSIOLOGICAL THEORY OF MARRIAGE: ONGOING RESEARCH AND SOME NEW HYPOTHESES

To return to our major theme, we set out in 1980 to explain three consistent patterns in marriage. Since then we have been exploring the interrelations among affect, affect reciprocity, physiological activation, physiological linkage, and marital satisfaction. Based on our findings thus far, we know that marital dissatisfaction is characterized by negative affect, negative affect reciprocity, and physiological linkage, which emerge most strongly during high-conflict tasks. We also know that future changes in marital satisfaction are encoded in patterns of negative affect reciprocity and in general physiological arousal that occur during marital interactions. Now we can begin to establish a theoretical model for understanding marital distress, and perhaps can apply this model to the design of therapeutic interventions that are based on these empirically confirmed differences between satisfied and dissatisfied marriages.

Reciprocity of Specific Negative Affects

With the specific effects and instances of emotional control coding system (SPAFF) and the Facial Action Coding System (FACS) we are examining the anatomy of negative affect reciprocity in terms of specific negative affects. We expect that not all patterns of specific negative affect reciprocity will be the same in terms of their implications for physiology. This is supported by recent work by Ekman, Levenson, and Friesen (1983), which found evidence for the hypothesis that specific facial con-

TABLE 3
PARTIAL SCHEMATIC OF AFFECT PATTERNING

Wife's anger	$\longrightarrow$	Husband's anger	$\longrightarrow$	Wife's fear
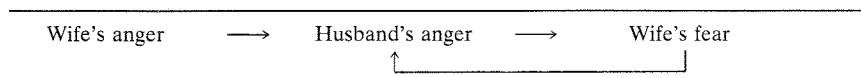
figurations associated with different negative emotions produce different patterns of autonomic nervous system (ANS) activity. In particular, the emotions of fear, anger, disgust, and sadness seemed quite different physiologically. We believe that the ANS is capable of many different patterns of response, including those associated with high level sympathetic nervous system discharge (the classic undifferentiated fight-flight response), those associated with different emotions, those associated with different kinds of physical activities, and those associated with different perceptual and cognitive states. The ANS is the slave to many masters, thus it is essential to employ markers from other domains (e.g., facial expressions, verbal content, self-report) to discover which master might be responsible for any observed patterning of ANS activity.

Emotional Control

We have become interested not only in expressed emotion during marital interaction but also in attempts at controlling emotion. We are currently exploring a pattern of emotional control that we call "stonewalling." Stonewalling is a way of dealing with being emotionally aroused or upset by inhibiting facial action, and minimizing gaze and listener backchannels (Duncan & Fiske, 1977). We believe that the inhibition of certain emotions may in itself be autonomically arousing.

A Physiological Basis for Sex Differences in Marital Behavior

Data from the ANS, in addition to being a source of dependent variables, can also be useful theoretically. We have recently theorized (Gottman & Levenson, 1985) that many commonly noted sex differences in relationships can be derived from a hypothesis about sex differences in ANS reactivity. This admittedly controversial hypothesis is that males show a larger ANS response to stress, respond more readily, and recover more slowly than females. Our review of the literature on sex differences in physiological responses to stress provided some support for this hypothesis. If this sex difference is true, and if chronic ANS activation is considered to be harmful, unpleasant, and undesirable, then men might be more inclined than women to avoid situations that would be associated with repeated high levels of ANS activation. Taking this argument a step further, if intense negative affect is seen as activating high levels of ANS activation (especially in men), then men may try to manage the level of negative affect to which they are exposed. They may try to create a rational as opposed to an emotional climate in relationships (which can be

a major source of repeated high level negative emotions and of concomi-tant high levels of ANS activation); they may become more conciliatory and less conflict-engaging than females; and they may try to terminate negative affect encounters by withdrawing. In this new paper (Gottman & Levenson, 1985), we present instances from the marriage research litera-ture that show that each of these behavioral characteristics has been ascribed to men. In direct contrast, women in this literature have been described as being less conciliatory, more conflict-engaging, and less likely to withdraw from negative affect.

Escape Conditioning Model

Another phenomenon we have sought to explain is the greater rigidity, predictability, and stereotypy of behavior in dissatisfied marriages as compared to satisfied marriages. In our efforts to explain this phenome-non we have developed an *escape conditioning model* of marriages, which links the reduction of physiological arousal with the reinforcement of behavioral sequences. This model has turned out to be two-edged: It may be able to explain both how marriages become more *and* less satisfying.

We are examining "escape moments" during martial interaction which are defined as occurring when both spouse's make the transition from high levels of ANS arousal ("upset") to low levels of ANS arousal ("calm"). We expect that the behavior patterns that accompany these escape moments will be reinforced and increase both in unconditional probability and in conditional probability (i.e., given ANS arousal). For an example of this kind of analysis we will consider the same couple whose data were presented previously. Table 4 compares two kinds of data: (a) the percentage of affect in three specific affect categories (de-rived from SPAFF coding) which occurred during escape moments; and (b) the percentage of affects in these same three categories that occurred during all other emotional moments. In general, the percentages of each category of negative affect that occurred during the escape moments are similar to those that occurred during the rest of the interaction, *with one*

TABLE 4

PERCENTAGES OF SPECIFIC NEGATIVE AFFECTS DURING ESCAPE MOMENTS AND OTHER EMOTIONAL MOMENTS

Spouse	Affect		
	Contempt and Anger	Whining	Sadness
Wife			
Escape moments	53.0	38.9	21.7
Other moments	6.7	24.0	18.0
Husband			
Escape moments	82.0	15.2	0.0
Other moments	77.7	12.0	0.0

exception. The wife, who is hardly ever angry or contemptuous (6.7% in the non-escape moments), is angry or contemptuous in 53% of the escape moments. For this couple, the wife's expression of anger is associated with the reduction in physiological arousal. Thus, according to the escape conditioning hypothesis, over time this couple's interactions should become increasingly more predictable; whenever the level of upset becomes great, the wife will resort to the expression of anger, and calm will be restored.

The escape conditioning model can be applied to the analysis of any relationship, and its theoretical contributions may be broad. For example, the escape conditioning model contributes to Patterson's (1982) negative reinforcement theory of coercive families by putting the chain of reinforcement in people's bodies. This removes an inherent circularity in the Patterson model pointed out by Knutson's (1982) critique. Knutson noted that negative reinforcement *must* occur as soon as aversive interactions terminate. Since these negative interactions do not continue indefinitely, he argued, negative reinforcement always occurs. He wrote: "Given an arrangement in which some negative reinforcement is always occurring in coercive exchanges, [it is difficult] to invoke negative reinforcement as a causal factor in escalation" (p.165).

The escape conditioning model eliminates this inherent circularity in negative reinforcement as an explanatory mechanism for the establishment of a particular (coercive) pattern. The escape conditioning model also would suggest that what changes is the conditional probability of coercion, given autonomic nervous system arousal. This was precisely Patterson's idea in his 1982 book.

To return to the question of why dissatisfied marriages show greater stereotypy of behavior, it seems likely that in unhappy marriages, there are many instances of upset over unresolved issues, and thus there will be many conditioning trials over which to strengthen the association that links a specific kind of upset with a specific behavior that serves to reduce that upset. In satisfied marriages, there will be fewer moments of upset, and thus fewer conditioning trials to establish rigid response patterns.

The escape conditioning model can also be used as a model for how relationships could improve over time. What makes people feel better and restores calm could just as easily be an empathic, loving response as the anger response seen in the previous example. Then, according to the model, this empathic, loving response should become more likely in the couple's repertoire as the response to upset. We do not know if this is what happens in couples whose marital satisfaction increases over time, but we are investigating this possibility.

SUMMARY

In this article we have suggested that observational methods have made a substantial contribution to our understanding of how satisfied and dissatisfied marriages differ. We have suggested that enough evidence

exists to identify three stable phenomena that we have chosen to explain in our construction of theory. We have then shown how the unique data base we have collected makes it possible to ask basic questions about emotion within the context of interaction and also to ask some basic questions about marriage. We discussed specific affect profiles, the role of physiological linkage and arousal, sex differences in autonomic nervous system response to stress, and an escape conditioning model that has implications both for understanding how relationships become more rigid and for understanding how they change.

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