Temporal Form: Toward a New Language for Describing Relationships

JOHN M. GOTTMAN
University of Illinois
at Urbana-Champaign

This paper suggests that we are engaged in a search for a new scientific language for describing relationships, which represents a move away from thought dominated by the analysis of the individual character. The concept of "temporal form" is suggested as a new basis for describing relationships. The idea is that, like an improvisational jazz group, a relationship consists of the temporal forms that are created when two people are together. The implications of this concept for both measurement and the construction of theory are discussed.

When Albert Einstein and Leopold Infeld looked back at the evolution of scientific thought in the seventeenth century, they were able to view the past with tremendous clarity. They could identify a century of scientific effort in terms of the development of one major idea that led eventually to the creation of the scientific method and a new theory of motion. The kind of clarity Einstein and Infeld had is nearly impossible to come by when people write about their own times. What, in our field, is the major idea we are working on in this century? Writing about our own time, many answers to this question seem possible. Events viewed from close range always seem complicated; and, because many paths are being traveled rather than one, any answer to the question of the one idea we are working on must appear overly simplified and limited to contemporaries. Nonetheless, that is the task of this paper.

We are currently in the center of a conceptual storm. Fortunately, we are, in a sense, in the eye of the storm, so that we can take a calm look back at where we have been as well as forward to where we are headed. I believe that the struggle we are engaged in consists of a *search for a scientific language for describing relationships.* Questions about what to measure and the unit of measurement are basic to the search for this scientific language.

We are emerging from nearly 2300 years of thought dominated by analysis of the individual character. In our own century this has been represented scientifically by research grounded in personality theory. This approach was, of course, pre-eminent in the early years of research into families. Consider some of the early research in our field on the determinants of marital satisfaction. My reading of this literature (for a more detailed review see Gottman, 1979) is as follows. The major conclusion that emerged from the early investigations was that variables that described the *relationship* were most important in accounting for variance in marital satisfaction (Burgess and Cottrell, 1939; Burgess and Wallin, 1953). In both cross-sectional and longitudinal research, the same patterns of results emerged. A research tradition grounded in *individual* personality theory paved the way for the study of relationships and demonstrated that the two modes of thinking (individual and relational) were by no means identical. The point cannot be made too

Prepared in response to an invitation to contribute to a *JMF* special issue on methodology.

The author wishes to acknowledge the support of NIMH Research Scientist Development Award 1K02MH00257. Requests for reprints should be addressed to Department of Psychology, University of Illinois, 603 E. Daniel St., Champaign, IL 61820.

strongly. For example, let us consider research on personality in marriages.

Studies comparing happily married with unhappily married couples found low to moderate correlations between self-ratings of happiness and personality indices. For men these correlations ranged from .28 (Dean, 1966) to .39 (Burchinal, Hawkes, and Gardner, 1957). For women the correlations were slightly higher, ranging from .35 (Dean, 1966) to .42 (Burchinal et al., 1957; Terman et al., 1938). However, the variables that characterized happily married spouses tended to be interpersonal rather than intrapsychic in nature. For example, in Burgess and Wallin's (1953) summary of the earliest investigations dealing with the relationship between marital adjustment and personality scale variables, happily married couples were characterized as emotionally stable, considerate of others, yielding, companionable, self-confident, and emotionally dependent. Dean (1966) noted that the personality variable with the highest correlation with both the husbands' and wives' marital adjustment scores was wives' positive rating of their husbands' emotional maturity. The research on personality variables and marital satisfaction thus points toward the interpersonal, not the intrapsychic domain.

In the late 1930s the point that relationships could not be understood by reference to individual personality theory was not well understood. For example, the prominent means of therapy for distressed marriages was individual therapy. As late as the 1950s it was considered *unethical* for the therapist to see husband and wife together and questionable practice for the same therapist to see both partners individually. Such was the influence of individual personality theory (for a review see Gottman, 1979: Chapter 14).

There was one lone voice who challenged these assumptions. As early as 1937 Nathan Ackerman blasphemously suggested that two neurotic individuals could have a happy marriage, and that the focus of therapy should be on *interaction patterns* (Ackerman, 1937; Ackerman and Sobel, 1950; Ackerman, 1954). Ackerman eventually was joined by a group of psychiarists led by Gregory Bateson. They published an extremely influential paper on the relationship between a type of family communication called "double-bind messages" and schizophrenic symptoms in children (Bateson, Jackson, Haley, and Weakland, 1956).

The double-bind hypothesis paper stimulated a great deal of interesting thinking about marital and family interaction patterns. The basic motto of this literature was *the whole is greater than the sum of its parts*, by which they meant that an *interactional system* is not capable of being understood by isolating its separate parts (for example, see Watzlawick, Beavin, and Jackson, 1967).

The point was forcefully made and has become largely accepted as truth despite the fact that no consistent scientific evidence exists supporting the original double-bind hypothesis (for example, see Beels and Ferber, 1969; Olson, 1972). As Bateson put it:

> . . . the double-bind theory of schizophrenia is *slippery*—so slippery that perhaps no imaginable set of empirical facts could contradict it . . . unfortunately, but necessarily, there is a basic formal truth about all abstract premises, namely: *The more abstract the premise, the more likely it is to be self-validating.* [1966:415-416; emphasis added]

Unfortunately, this extremely honest (and perhaps cynical) statement has been all but forgotten. Despite the dead ends of research designed to test the double-bind hypothesis, by the 1960s it became clear that the study of interaction per se might be valuable in understanding how *systems* functioned or malfunctioned. By the mid-1960s a great deal of observationally based literature existed that suggested how social groups functioned (e.g., Bales, 1950) and also suggested that groups with an interactional history were different from groups of strangers (Hall and Williams, 1966). Also, by the mid-1960s some consistent findings were emerging in family interaction research. Regrettably, these consistencies were largely ignored. For example, Riskin and Faunce's (1970) decade review paper suggested that one consistent finding was that agreement-to-disagreement ratios greater that 1.0 characterized normal families and that ratios less than 1.0 characterized distressed families. This consistent finding was considered dull and unglamorous; perhaps it even seemed somewhat circular. Researchers tend to be much more charmed by and attracted to complex conceptualizations such as Leary's (1956, 1957) circumplex model or what might be called Laing, Phillipson and Lee's (1966)

"meta-meta-etcetera" model of interaction. To conclude that partners in distressed marriages disagree more than they agree hardly seemed like a profound conclusion.

Despite this general situation, the point that agreement-to-disagreement ratios were consistently different for distressed and nondistressed families was not lost on Gerald Patterson and Robert Weiss at Oregon, whose work has been motivated by the integration of general systems theory and social learning theory. They had been intrigued by cybernetic, or "general systems theory" concepts, but only after they had come to value the importance of measuring observable behavior and of producing testable hypotheses. Perhaps most important were the methodological advances made by the Oregon group, in particular, the Family Interaction Coding System (Reid, 1967; Patterson, Ray, Shaw and Cobb, 1969) and the Marital Interaction Coding System (Hops, Wills, Patterson, and Weiss, 1972). These methodological advances led to thinking about relationships as interacting systems, which led to a search for interaction patterns that characterized distressed marriages.

To summarize, I believe that we in Family Studies have been struggling to free ourselves from this emphasis on individual functioning. From their inception, interactional viewpoints have referred back to the *individual's* functioning. The struggle has not been easy. For example, in their 1960 decade review paper, Hill and Hansen presented the 1950s view of interaction in families. They wrote:

> An interactional conception of the family takes these lines: The family is a unity of interacting persons, each occupying a position(s) within the family to which a number of roles are assigned, i.e., the *individual* perceives norms, or role expectations held individually or collectively by other family members for his attributes and behavior. In a given situation, an *individual* defines these role expectations in view of their source (reference group) and of his own self-conception. Then he role-plays. Most immediately the family is studied through analysis of overt interacts (interaction or role-playing family members) cast in this structure. [1960:302-303; emphasis added]

As can be seen from this quotation, interaction in the 1950s clearly was viewed from the perspective of understanding the individual. That has changed very slowly. In the early 1960s the group of psychiatrists and therapists led by Gregory Bateson founded the journal *Family Process* to represent their developing ideas about general systems theory. In March 1962 the editorial policy of this new journal was stated as follows:

> We can no longer afford the error of *evaluating the individual* in isolation from his usual environment or appraising that behavior in artificial settings. We must *study the person* where he breathes, eats, sleeps, loves and where he learns his place in society: In the intimate climate of his day-to-day family relationships. [Editorial policy . . ., 1962: 2; emphasis added]

Notice that the *justification* for studying families still was stated in terms of understanding the individual. The first issue of the journal went on to describe its dedication to understanding the relationship between *individual psychopathology* and types of families. It is the case that family distress is related to a wide variety of physical and psychological problems, although our ability to predict which specific psychiatric diagnostic categories people in distress will display is low. However, this knowledge is not necessary to justify an interest in understanding relationship functioning and dysfunctioning in families. Currently this point has profound implications for public policy in the federal funding of research in families. Despite this rhetoric about the study of individuals, the journal actually devoted a great deal of its space to methodological discussions of how to best study families; and here lies its major contribution, because subsequent issues of the new journal were devoted to the belief that the best way to classify families was through the direct study of family *interaction.*

METHODOLOGICAL BREAKTHROUGHS

The 1960s and 1970s were concerned with the development of appropriate methodologies for the study of family interaction. This was a necessary achievement in the struggle for a language to describe relationships. Several important breakthroughs in our conception of methodology were necessary before we could study interaction directly. It is necessary to study interaction directly because our attempts since the 1930s to understand marriages have always had in mind the scenarios and scripts of the interactions that characterize these relationships. We must face the fact that at this juncture nothing else real-

ly has explanatory power. For example, suppose we discover that a variable such as disparity in education between spouses is negatively correlated with marital satisfaction. How would we *understand* this relationship? We would have to imagine how the difference in the spouses' education functions and affects their interaction. In short, to understand how variables in the study of social interaction operate, we have to make inferences about processes we usually do not directly observe.

A major breakthrough in our attempt to develop a language for describing relationships, therefore, was the development of the methodology for direct observation of family interaction (for an historical review see Gottman, 1979). A second breakthrough in our attempt to develop a scientific language for describing relationships is the relatively recent realization that we need to be concerned with *interaction patterns*.

The Search for Pattern

In an excellent review of the relationship between family interaction and child psychopathology, Hetherington and Martin wrote:

> Most of the studies of family interaction have yielded separate frequency measures of parent and child behavior recorded while they were interacting. However, investigators are usually actually interested in the etiology, contingencies, and sequencing of these observed behaviors and often generalize to such questions on the basis of inappropriate methodology. . . . *Such studies should look sequentially at interchanges involving chains of interpersonal exchanges* and should investigate shifts in probabilities of response in one family member to the specific behavior of others. [1972:36; emphasis added]

This call for sequential analysis was echoed recently in research on parent-infant interaction. Schaffer (1977) noted that the infant's preprogrammed neural organization for face-to-face interaction is probably manifested in temporal organization, and he recommended sequential analysis rather than analysis based on total amounts of behavior as the technique of choice for data reduction. The techniques for both the direct observation of interaction and the detection of sequential pattern have become much more available to researchers in recent decades (for example, see Gottman and Bakeman, 1979), although essentially they have been in existence since 1949 (Shannon, 1949).

Until recently, most research on interaction has ignored sequence and collapsed data over time. For example, whereas all the hypotheses of pathological family interaction concerned the patterns of interaction, none of the 57 research studies reviewed by Jacob (1975) were concerned with pattern. They all presented analyses of the differences in rates of various behaviors. By the choice of their data analytic methods, the authors of these studies made the implicit assumption that the more of something good, the better, and the more of something bad, the worse. In many instances this is a tenuous assumption simply because not all interruptions in a dialogue may be the same. Interruptions may initiate one kind of sequence, such as a negative affect cycle, in distressed families; and a different kind of sequence, such as humor, may occur in nondistressed families. In other words, the vast majority of research on family and marital interaction has not always analyzed the patterning between actions over time.

Until recently, in fact, this state of affairs also has characterized research on marital interaction. For example, perhaps the most influential hypothesis about marital interaction in the literature has been the quid pro quo hypothesis suggested by Jackson (1965). Jackson cited a study by Leik that found that "the traditional male role (instrumental, nonemotional behavior) appears when interaction takes place among strangers. These emphases tend to disappear when subjects interact with their own families" (Leik, 1963: 145). As one example of a quid pro quo, Jackson suggested, "If A says to B, let us do X, spouse B assents because they have established a time-bound relationship in which the next move would be B's. The husband may suggest to his wife that they go to a movie; she says yes, and then she has the right to say, we can have a beer afterwards" (1965: 1538).

In 1968 Lederer and Jackson published an influential book called *The Mirages of Marriage*, in which they elaborated on the quid pro quo concept and suggested a form of therapy called *reciprocal contracting* as a treatment for distressed marriages. Note that the quid pro quo interaction pattern had never been carefully established by quantitative, observational research as a phenomenon characteristic of marriages that both partners consider mutually satisfying or as one failing

to characterize distressed marriages. The quid pro quo concept was, nonetheless, so intuitively appealing to behaviorally oriented therapists that is was rapidly adopted. In 1969 Stuart published a paper in which he reported that four couples established reciprocal contracts. In 1976 he again reported, but rather briefly and casually, that he had obtained high rates of success with reciprocal contracts (approximately 84%) with a large sample(200 couples) and had measured improvement with his own Marital Precounseling Inventory. Clearly, the reciprocal contract, despite its lack of empirical support, became the treatment of choice for many behaviorally oriented marriage counselors (see also Jacobson and Martin, 1976). It is important to note that reciprocal contracting therapy, when it has been correctly evaluated with instruments of established psychometric properties (e.g., Jacobson, 1977), always has been considerably modified, for example, by adding training in problem-solving or other communication skills (see Patterson, Hops, and Weiss, 1975; Weiss, Hops, and Patterson, 1973). Clearly, most clinicians found the quid pro quo alone to be an inadequate basis for intervention.

This clinical theorizing ignored existing research that pointed to the potential importance of describing sequential patterning in marital and family interaction. Among these studies was Haley's research on a variable called "R-deviation." This research was based on the most primitive of all possible coding systems; it contained only two codes for each family member: talk and silence.

Haley (1964) studied talk patterns in three-person (two parents and a child) "disturbed" and "normal" families. The disturbed group of 40 families included those in which some member (a) was diagnosed schizophrenic, (b) had committed a delinquent act or (c) had been referred for a school problem. Also included in the disturbed group were families in which a member sought help for "a neurotic problem" or in which the parents sought marriage or family therapy. They were considered normal because they had not come to the attention of the community as having problems. Children ranged in age from 10 to 20 and were living at home with their natural parents.

The process measure that resulted in the greatest separation of disturbed or normal families on Haley's tasks was obtained by using a "Family Interaction Analyzer" devised by the Alto Scientific Company of Palo Alto. Using lavaliere microphones, the interaction analyzer automatically records the frequency with which each member's talk is immediately followed by that of another family member. When father speaks, for example, nothing happens until mother speaks; then a click is recorded on the father-mother (FM) counter.

Haley's measure, R-deviation, was the extent to which the sum of the percentage of speech in each of the six categories (FC, FM MF, MC, CM, CF) deviated from what would be expected in a random talk pattern (16.66 in each category). The R-deviation measure is actually a naive approximation to an information theory search for "digram structure." Digram structure means that immediate temporal linkages exist. Haley was not controlling for imbalance in the frequencies of M, C, and F. He hypothesized and found greater rigidity, more limited response alternatives chosen, and, therefore, greater R-deviation scores in pathological families. The results of this experiment, thus, suggested that temporal structure is itself an index of poor functioning in families. Regrettably, Haley's results did not extend to four-person families (Haley, 1967); however, Waxler and Mishler (1970) studied four-person families and solved the mystery. They found greater rigidity in temporal sequences when mother and father interacted with the identified patient child, but not with the other child. Thus, it may be that, with respect to potentially conflict-producing interaction, distressed families have developed structured interaction rules for family subgroups and that R-deviation (or Waxler and Mishler's T-statistic) is tapping this interaction structure. This was an extremely exciting finding and it should have led to a flurry of interaction research that directly studied sequential pattern. Unfortunately, its time had not yet come.

To summarize, we have had an example of the first program of research with families that investigated temporal patterning, and this research suggested that the presence of a temporal structure is associated with distress in families. This was not consistent with the quid pro quo hypothesis, which suggested that a specific kind of temporal structure was characteristic of well-functioning relationships. More descriptive detail was necessary

because the quid pro quo hypothesis stressed the functional aspect of *positive* reciprocity, and a simple talk-silence coding system could not address this question. Clearly, an expansion of the categories from a talk-silence system to include at least a positive-negative dimension of some sort was needed. The issue, however, was how should "positivity" and "negativity" be defined and measured in the study of family interaction? This was and is not an easy question to answer. A clue to its answer lies in the remarkable consistency that has been found in the differences between people's interaction with their spouses and opposite-sex strangers.

Ryder (1968) asked the question, "What, if anything, is demonstrably distinctive in interaction between husbands and wives?" Using a decision-making task (The Color Matching Test), he paired husbands with their wives or with female married strangers. He found that husbands were more likely to lead the conversation with their wives but not with strangers, that wives laughed less and disapproved more with spouses than with strangers. In general, spouses were far more polite and positive to strangers than to their partners. The effect was replicated by Birchler, Weiss and Vincent (1975) for a high-conflict problem-solving task (the IMC) and for simple conversation in a comparison of stranger dyads and nondistressed couples.

Winter, Ferreira, and Bowers used their standard decision-making task to study interaction in married and unrelated couples. Replicating Ryder (1968) and Bircher et al. (1975), they found that "unrelated couples were more polite to each other than were married couples" (1973:91). They also found that married couples intruded upon and interrupted each other more often than unrelated couples and that unrelated strangers listened respectfully to one another, whereas married couples were often rude. Also, interruptions by spouses decreased subsequent talk by the spouse who was interrupted; whereas among strangers, interruptions increased the subsequent talk of the partner who was interrupted.

The concept of "nice versus nasty," rudeness, or negative affect emerged from this literature; in fact, it has turned out to be extremely profitable to invent categories that globally code interaction along this type of positive-negative affect dimension. Birchler, et al. (1975), using the Marital Interaction Coding System, combined their categories of positive verbal and nonverbal behavior. They were able to discriminate distressed from nondistressed couples on the mean rate per minute of negative codes in both a problem-solving (IMC) task ($t = 1.724$, $p < .05$) and in conversation ($t = 1.982$, $p < .05$). They also were able to discriminate distressed from nondistressed couples on positive codes, but only on the problem-solving task ($t = 2.164$, $p < .025$). These findings are consistent with other research on family interaction (e.g., Alexander, 1973a, 1973b; Cheek, 1964; Caputo, 1963; Mishler and Waxler, 1968; Riskin and Faunce, 1970).

In a study of couples' behaviors at home, Weiss, Hops and Patterson (1973) computed a pleases-to-displeases ratio using a behavioral checklist kept daily by couples as an outcome measure of their marital therapy program. They reported that the seven couples seen in their program (who were shown to have improved on other variables) increased their pleases ratio. Wills, Weiss, and Patterson (1974) showed that pleases and displeases were able to account for substantial portions of the variance in a daily global one-item rating of marital satisfaction in seven nondistressed married couples.

To summarize, it appears that it would be very fruitful to expand the talk-silence category system to include a positive-negative affect dimension. It also would be fruitful to continue to study temporal patterning in marital and family interaction.

A great deal more precision is now possible in the study of affect, beyond a positive-negative dimension. This brings me to a brief discussion of what I see as the third major breakthrough toward a language for describing relationships, namely, recent innovation in the past decade for studying affect in interaction.

The Study of Affect

The fields of nonverbal communication and the study of emotions have grown rapidly in the past decade, and this paper will not review these fields. For an introductory review, the reader is referred to Harper, Wiens, and Matarazzo (1978). However, I do wish to make one point about the study of affect that is not currently accepted, but which I believe is true. Anyone who seriously investigates emotional communication within the flow of conversa-

tion must come to the conclusion that affect is conveyed in every possible channel of communication: linguistic, paralinguistic, facial, gestural, and proxemic.[1] Furthermore, it rapidly becomes obvious that these channels of emotional communication can not be isolated, separately investigated, and then later reintegrated. Birdwhistell said it nicely: "Studying nonverbal communication is like studying noncardiac physiology" (quoted in Knapp, 1972:3). Birdwhistell was challenging the "additive channel model" of nonverbal communication that is currently mainstream. The additive model claims that to study affect we must study nonverbal behavior, which implies that we must eliminate the verbal "channel" from our study or we will contaminate our results. The idea is, thus, that by using the appropriate technology, the contribution of each channel (voice, body, face, proxemic cues) is separately assessed, and then put back together again. This can be accomplished only if these channels combine in an additive and not in an interactive manner. Hence, I am referring to this as the additive channel model.

To see the truth in Birdwhistell's point, consider the vocal channel for a moment. Current scientific methods require the removal of content from speech in order to isolate vocal components of emotion. This is done either by electronic filtering of high frequency cycles or random splicing (see Scherer, 1982). There are problems with each method. Emotional communication has been found to occur precisely in high frequency shifts of the voice (Rubenstein and Cameron, 1968), which suggests that electronic filtering may be eliminating precisely the information of interest. Random splicing techniques lose temporal form so that an angry moment characterized by steadily rising volume will be spliced randomly, rendering its temporal shape unrecognizable.

There is a logical reason for agreeing with Birdwhistell. Suppose you tell your secretary, "I'd like this as soon as possible." If you stress the word "soon," it will communicate impatience; if you stress the word "possible," it will communicate that you are not in a hurry. Any content filtering will lose the emotional flavor of the *interaction* of paralinguistic cues with the words. A bit of experience with conversation will convince the reader that the argument can be generalized to other cues in the voice, such as pause, whine and so on. The point is that an additive model of nonverbal channels is not tenable: *emotion is communicated by a nonadditive gestalt of channels.* You cannot take Humpty Dumpty apart, study the separate pieces and even hope to learn about Humpty Dumpty.

This is *not* to say that physical cues of nonverbal behavior do not provide reliable emotional information independent of language. On the contrary, the researcher of emotional communication must know all channels well.

Consider the face. The study of facial expressions was discredited in psychology in a review by Bruner and Tagiuri that appeared in the 1954 *Handbook of Social Psychology.* In 1972, Ekman, Friesen, and Ellsworth critically re-evaluated the evidence before and since the Bruner-Tagiuri review and reported several important points. First, Bruner and Tagiuri misinterpreted and distorted the research evidence. As Ekman et al. wrote: "Bruner and Tagiuri were factually incorrect and misleading. They enhanced the credibility of negative findings on accuracy by saying that all of those experiments utilized photographs of real emotion elicited in the laboratory. This is true only of Landis and Sherman" (1978:78). Second, the studies included in the Bruner and Tagiuri review suffered from several methodological weaknesses. For example, early investigators of facial expressions expected to find an isomorphism between emotionally arousing situations and universal facial expressions. We now know that any number of factors may intervene to ruin this one-to-one relationship. It was not surprising that subjects in these studies were unable to accurately identify emotion from facial expressions. The assumption that a particular experimental event would produce the same internal state in all subjects was invalid. A third point and another methodological weakness was that persons used for the stimuli photographs in some studies were colleagues of the experimenter (Landis, 1924, 1929). These coexperimenters, thus, were aware of what was being measured and, in most situations (such as suddenly placing excrement under their noses), produced the same expression—a pained, polite smile. When subsequent subjects were asked to match situations with photographs, it is predictable that they did no better than chance. Finally, the stimuli

situations followed one another in rapid succession, which may have contributed to individuals producing blends of various affects. Ekman et al. (1972) showed that, when these methodological problems are controlled, subjects can accurately identify facial expressions. This result has been replicated in many investigations by several researchers (for example, Izard, 1971).

Currently, the state of the art in measuring facial action is clearly Ekman and Friesen's (1978) anatomically based Facial Action Coding System (FACS). This system is a tremendous scientific tool because it gets the investigator away from using emotionally laden adjectives in describing facial motion. To explain the great clarity that eventually will be gained by using FACS, consider one category that many researchers use, the *smile*. Most of us think we know what a smile is. Most investigators have specified simply that the lip corners are up in a smile and that the mouth is shaped somewhat like a U. This will not do at all. Quite a number of different types of smiles have the lip corners pulled down. The smile often is seen in coy, playful, or flirtatious interaction; it looks like the person is working hard *not* to smile. The FACS would describe each smile in terms of the "action units" (AUs) that are involved in creating the facial configuration. Many "smiles" involve upturned corners of the mouth but are often indices of negative affect. For example, the symmetrical of asymmetrical configurations produced by AU14, the dimpler, resemble the proper reaction to a bad pun, a common contempt expression. In short, a smile is not a smile; it depends. The same is true for other parts of the face. For example, an excellent discussion of the variety of possible emotional and conversational functions of brow movements may be found in Ekman (1979).

Research on other channels of nonverbal behavior also have produced interesting cues that may suggest emotional states. For reviews of these literatures, see Harper et al. (1978) and Scherer and Ekman (1982). It is certainly clear at this point that researchers who are interested in studying affect in marital interaction have to become familiar with an important body of literature on emotion. Unfortunately, this familiarity is rarely displayed in the literature on marital and family interaction.

To summarize, I have reviewed three breakthroughs toward the development of a language for describing relationships: (a) the development of a quantitative observational research methodology, (b) the development of tools for the sequential analysis of observational data, and (c) the development of precise methods for describing affect in interaction. I would now like to review a theoretical domain that I consider part of the study of people's perceptions of their interaction, namely, social exchange theory.

Social Exchange Theory

In my view, a fourth breakthrough in our struggle for a language to describe relationships has been the development of exchange theory. The time has come, however, to label exchange theory as a theory in how people *perceive* interaction, not a theory of interaction per se. This was clearly implied in Kelley's (1979) recent book on personal relationships. In his second chapter Kelley describes obtaining data from one couple's perception of the rewards and costs to each of them of various configurations of sharing household chores. It is important to note that the payoff matrices were obtained by the couple's response to a questionnaire. Rewards and costs are, thus, aspects of perception, not action. In fact, Kelley constructed imaginary scenarios for each type of interdependence matrix he discussed; without these matrices the explanatory power of his theory is weakened. He wrote: "Any particular pattern of interdependence has latent within it certain possible courses of action—plausible scenarios of action and reaction, communication (requests, complaints, threats, promises), and the associated feelings" (1979:43). It is obvious that this is, in part, circular, because the interdependence matrices are themselves ways of tapping the "associated feelings" of the plausible scenarios. Nonetheless, exchange theory is a way of simplifying and systematizing the *pattern* of perceptions a couple has about their relationship. It is clear that perception is the cornerstone of exchange theory. It may be less clear that pattern is essential. In fact, Kelley wrote that the major contribution of exchange theory was not the identification of rewards and costs of interaction but the identification of patterns of these reward-cost consequences (Kelley, 1979:23-24).

Hence, social exchange theory can be seen

as one system of thought that taps the reward-cost aspects of people's *perceptions* of their interaction. Thibaut and Kelley's (1959) work focuses entirely on one dimension of people's perceptions of relationships, a positive-negative dimension. Work by Osgood, Suci, and Tannenbaum (1975) on people's judgments and meanings suggests that most of the variance in human judgments can be accounted for by an overall evaluation, or positive-negative dimension. It may make some sense, therefore, to focus on the evaluative component of people's perceptions. It is also possible that *patterns* of perception, along an evaluation dimension, index other important dimensions of perception. For example, Kelley argued that patterns of positivity tap dimensions of power; he suggested that the most dependent person is viewed as the least powerful. This is the case, Kelley argued, because the more dependent person attends more to the care of the relationship than the less dependent person does. This is reminiscent of Chance and Jolly's (1970) discussion of power and dominance in nonhuman primates, which they discussed in terms of an asymmetry in attention. The subordinate animal needs to be continually aware of where dominant animals are and what they are doing; the converse is less true. This sets up an asymmetry in attention and responsiveness that reflects the dominance structure.

To summarize, I have suggested that the direct observation of behavior and affect, the search for temporal patterns, and the use of social exchange theory as an index of people's perceptions of their interaction are the tools we need for creating a language to describe relationships. All four "breakthroughs" increase the specificity and power of our ability to describe relationship patterns. I would argue that it is precisely our increased ability to describe relationships that eventually will lead us to the new language that we need for describing relationships. Before this can occur, it is important for the people in Family Studies to reconsider our conceptualization of what a relationship is.

TEMPORAL FORM: OR WHAT IS A RELATIONSHIP?

I would like to suggest one conceptualization of what a relationship is, based on a notion that I call "temporal form." In our thinking about nature, time is so fundamental that it has not been considered the material substrate for the construction of social relationships. Yet the often-used concept of "structure" in social interaction requires that, over time, a temporal form is spun by interactants, much as if together they had constructed a physical shape. I suggest that *a relationship consists of the forms that people build when they are together.* Their affects and cognition about the temporal forms they construct will determine their satisfaction with the relationship. I suggest here the analogy of a jazz improvisational group. The music such a group generates is, in fact, temporal forms of sound. In a similar way, a relationship generates temporal forms of behavior. These forms are as real and as ephemeral as the music an improvisational jazz group generates.

Before I continue this discussion of *temporal form*, I would like to distinguish between probabilistic and deterministic approaches to the detection of pattern over time. The distinction is critical from both a methodological and a philosophical perspective.

An Empirical Approach to Discovering Temporal Form

Duncan (1969), in a review of research on nonverbal behavior, distinguished between two broad research strategies, the "structural approach" and the "external variable" approach. In the structural approach nonverbal behavior is considered a self-contained system with a definite set of rules like a language. The external variable approach seeks meaning in nonverbal behaviors in relation to other variables. Harper et al. noted that an important difference between the two approaches is in the use of statistics by the external variable approach. In fact, they wrote that "structuralists have not concerned themselves with whether individual elements occur together; if they are natural elements of a communication structure, they will be present every time" (1978:13).

The structuralist approach, thus, is a deterministic approach rather than a probabilistic approach to communication. This fact about the structural approach recently was described clearly by VonCranach and Vine. They wrote that on of the "theoretical commitments" of the structural approach is that, "until counterevidence appears, all behavior is considered to be communicative, with mul-

tiple meanings at a variety of levels of integration. The relations between parts of the system are not probabilistic . . ." (1973:3).

Those who have called attention to regularity and pattern in social interaction can be classified into two types, "deterministic" and "probabilistic" theorists. Those who write rules of social behavior, such as sociolinguists, who describe the rules for using imperatives in discourse or a function of the familiarity and differential status of the speakers (Ervin-Tripp, 1977), are deterministic. They certainly would subscribe to the fact that discourse does not always and exactly mechanically follow the rules; they would agree that error and other random factors enter in; but, by and large, they assume that the rules are essentially fixed within a speech community. The pattern exists, even if it is embedded in noise. The determinists can be identified easily from the fact that they are willing to write rules from relatively brief samples of interaction; for example, Labov and Fanchel's (1977) book *Therapeutic Discourse* is based on 15 minutes of interaction from one session of psychotherapy.

On the other hand, probabilistic theorists require vast amounts of data and employ information theory to infer that a temporal structure may have generated the data. The concept of information often has been misunderstood and misapplied to the study of structure in social interaction. A particular message, by itself, contains no information. Any information present exists only in reference to the alternative messages that are possible. Thus, in practice, information cannot be determined except with reference to a large corpus of alternative messages. The term information, therefore, applies to a *type* of message with respect to a particular ensemble of messages. As a result of this misunderstanding with regard to the term "information," the two types of theorists, unfortunately, have not been sharply distinguished. The use of statistics and information theory has direct implications for the definition of "communication" that probabilistic versus deterministic theorists use. The deterministic viewpoint was well expressed by the general systems theorists Watzlawick et al., who state as an axiom of their theory of communication:

> To summarize, a metacommunicational axiom of the pragmatics of communication can be postulated: *one cannot not communicate*. [1967:51]

On the other hand, the probabilistic theorists' view of communication was well expressed by the ethologist Wilson. If individual A displays behavior X_1 with probability $p(X_1) \neq 0$ and individual B displays behavior X_2 with probability $p(X_2)$, then

> communication occurs when $p(X_2/X_1 \neq p(X_2)$. In other words, the conditional probability that act X_2 will be performed by individual B give that A performed X_1 is not equal to the probability that B will perform X_2 in the absence of X_1. [1975:194]

Using the latter definition, it is quite possible for an individual not to communicate.

The probabilistic approach to the detection of temporal form may begin by identifying small chains of interaction and then build to longer chains as data becomes available (Patterson and Moore, 1979) or as new and larger coding units are employed.

The Apprehension of Form

It may seem at first that most people are probably not ideal informants about the temporal forms they themselves generate when they are together. People are usually unaware of even the public rituals they engage in such as turn-taking signals in conversation (Kendon, 1967). However, this may not always be the case. Forbes and Lubin (1979) used a videotape-recall interview method with preschool children and discovered that children were quite capable of describing their thoughts, plans, motives and feelings when they could refer to the videotape. Robert Levenson and I used a video-recall procedure with married couples and found that couples' recall ratings of their affect during the interaction correlated highly with marital satisfaction. In a series of studies using a "talk table" that asks people as they interact to rate the intended positiveness of messages they send and the positiveness of messages they receive, Gottman(1979) reported that: (a) these perception variables discriminate satisfied from dissatisfied marriages; (b) the discrimination is often possible independently of the level of conflict of the task the couple is discussing; (c) in an extremely important longitudinal study by Markman (1981) of couples planning to marry, these variables were found to be strongly predictive of relationship satisfaction

five years later; and (d) temporal patterns of the positivity of the couples' perception discriminated satisfied from dissatisfied couples in the same way that observation data of the positivity of the couples affect did.

These results do not speak to the issue of the extent to which people are aware of the temporal forms or patterns that characterize their relationships. This information is currently unknown. We do know that people's thinking about social events tends to be unique. For example, Glick (1978) argued that social cognition differs from other forms of cognition in two ways. First, he argued that social cognition is more intuitive than logical. He argued that people use different, more intuitive information processing strategies when processing socially relevant information rather than more cognitive (e.g., geometric) information (Bruner, Goodnow, Austin, 1962). Recent work in script theory (Abelson, 1976; Nisbett et al., 1976; Schank and Abelson, 1977) has demonstrated similar patterns. When people process socially relevant information, they prefer intuitive to rational processing strategies.

Second, Glick argued that social events should display less regularity than physical events and "hence should involve knowledge structures of a more probabilistic sort" (1978:3). However, he argued that a distinction needs to be made between rule-regulated and rule-recognized behaviors. He asserted that "rule-recognized behaviors conform to our understandings of formulable cognitive knowledge" (1978:6). This is consistent with the previous discussion of probabilistic approaches to the detection of temporal form.

In the absence of knowledge about the effect of people's apprehension of the temporal forms they generate in their relationships, let me speculate. As with music the social temporal form may be recognized and responded to by the interactants. Even this simple cognitive act may have a powerful implication for the relationship. I suggest that *the apprehension of temporal form implies its possible metamorphosis*. The next time the temporal form arises, it can be changed. The nature of the change is, in a sense, a move from probabilism toward determinism, i.e., from less to greater structure. Once two people are aware of a temporal form, they can refer to it briefly and telegraphically. Thus, it moves from a likely form in a probabilistic sense to a ritual that can be referred to, used or modified at will.

An illustration of this metamorphosis of temporal form from probabilistic to deterministic (ritualized) as a result of the apprehension of form comes from research on the nonverbal social interaction of toddlers as it has been described carefully by Mueller (e.g., see Vandell and Mueller, 1980). Mueller noted that young infants of 13 month will begin their social relationship by simply sharing the same physical space; one particular dyad performed this pattern repeatedly, with great eventual delight. Mueller's films of these two children is an excellent illustration of how the mutual apprehension of a simple temporal form causes its metamorphosis. The second time the first child climbed up to the same platform he had previously shared, he looked back at his partner, who seemed to accept the invitation to repeat the game. Mueller's description of the development of social relationships also describes asymmetrical imitative sequences (e.g., one child says "ah," and the other imitates, then the first child says "eh," and the other imitates), and symmetrical imitative sequences (in which both may initiate). These sequences are rapidly apprehended and undergo a rapid metamorphosis to a game. Garvey and Hogan (1973) and Garvey (1974) described temporal forms of the pretend play of preschool-age children they called symmetrical" and "asymmetrical rounds". These forms may be called *temporal fugues* because they create a first theme, or subject, a countersubject, and their transformations and variations on these themes.

Social development, then, appears to involve increased complexity of probabilistic temporal forms and of the ability to apprehend and metamorphose forms within deterministic patterns. A similar process may occur within one relationship; that is, to the extent that temporal forms are apprehended, they can be changed and variations can emerge. At this time we have no evidence that this is the case.

In research on parent-infant interaction, we can find an illustration of the metamorphosis of temporal form from probabilistic to deterministic and to mere ritualized play that rapidly metamorphoses from brief bouts of face-to-face smiling and vocalizing to complex games such as peekaboo. Writers in this

research areas have listed a wide range of patterns that even young infants display, including attention-getting initiations and turn-taking during play (e.g., see Stern, 1974). At first the parent's objective is eliciting prized baby behaviors such as interest, body orientation toward the parent, eye-to-eye contact, smiling, vocalizing, the baby's pumping of its limbs, and the sequential occurrence of all of these behaviors that indicates the baby's engagement in social play. The parent's contribution to the form includes specific kinds of pitch changes, repetitive rhythmic vocalizations and motoric play; as the baby gets older the parent's contributions shift to more complex games, such as "I'm gonna get you."

To summarize, I have suggested that a relationship can be conceptualized as the temporal forms that people create and their cognitive apprehension of these forms, entailing the possibility for the metamorphosis of these forms.

How would a research program proceed if it chose to follow these suggestions? The next section illustrates two steps toward making this relatively lofty discussion more concrete. First, I describe a study currently in progress by presenting a discussion of an excerpt of a couple's conversation. The goal of this presentation is to illustrate how an actual piece of interaction can be summarized in terms of the recurring temporal forms that are generated. The next step is to summarize those temporal forms that consistently discriminate couples in families along a criterion variable of interest; in my case this is satisfied from dissatisfied couples.

ILLUSTRATING TEMPORAL FORM

Step One: Description Using Temporal Form

This is a step toward making concrete the notion of probabilistic temporal forms in interaction. It comes from a study I conducted with Professor Robert Levenson of Indiana University. In this study we collected videotape data on marital interaction as well as psychophysiological data designed to tap a domain of emotion responding, represented by activity of the sympathetic nervous system. The sympathetic nervous system is related to the body's response to emergency by arousal, activation, fight or flight. Couples also returned for an additional order recall session in which they watched their own videotapes and provided a continuous self-report measure of their affect, from positive to negative. The physiological, self-report and videotape data that were obtained in the recall session were all synchronized to a time code of the original interaction. The discussion I summarize is a couple discussing the events of the day, after they have been separated at least eight hours.

Every researcher who directly observes interaction has a unique way of coding the interaction, selecting the interaction unit, and so on, determined, of course, by the set of research questions of interest. Levenson and I are interested in the expression of emotion and emotional responsiveness. Hence, the temporal forms I use to summarize this interaction have to do with *patterns of emotion.* To code the interaction a variety of coding systems are employed, including an analysis of facial action, voice tone, words, paralinguistic cues, and so on. I summarize these codes in words.

The conversation begins with the wife telling a story of how her day has gone. She describes an incident of a lost bracelet. The important thing to note, however, is *how* she tells the story. As the wife tells the story of the lost bracelet, she begins to act anxious and fearful—she starts pausing more, clearing her throat, increasing the number of speech disturbances (for a review, see Harper et al., 1978: chapter 2), looking down and avoiding eye contact, and increasing the frequency of a facial expression classified AU14 ("dimpler") on the FACS, which is associated with contempt (as can be seen from further study of the interaction, this expression is probably indicative of self-contempt). The husband's face remains motionless except for the fact that he is looking at her from the side, i.e., his head is turned away from her while his eyes are looking directly at her, and the appearance is one of distance, smugness, disdain. She begins her story:

W: Well, honey how are you doin' today?
H: Just fine. What did you do today, honey?
W: Oh, I did pretty good at work. I made two sells.
H: Did you?
W: Ya.
H: What else did you do?
W: Well, Susan got upset.
H: Did she?
W: She's still havin' problems with her boyfriend, so . . . well her and Peggy invited me to lunch and well, you know, I haven't been out with

them for a while, so we went over to Pizza Hut and I had a salad and two pieces of pizza and a beer. I had a nice time there, and then I went to the store and come home. And, a, well you know, that bracelet that I bought from Terra, well, I lost it today. (5:50) (5:52) And, well, you know, the clasp on it wasn't very tight (pause). So, I back-tracked and went everywhere lookin' for that bracelet. I couldn't find it anyplace, an', so I posted up notices at the IGA store, Value Plus where I went and back at the Pizza Hut and everywhere. And I didn't even get home until shortly before you got home. And then I straightened up the apartment, and, a, (clears throat) you know, and I thought, well it was gettin' so close to the time you were gonna get home, I thought I'd let you come home and take a shower first, before I took a shower. (6:25)

What is she telling her husband? She chooses to tell the story in a particular way. She feels the need to point out how the loss was probably not her fault (the clasp wasn't very tight). She tells him how thorough her search was. She tells him how she put notices up. Then she tells him what a good wife she is: she straightened the apartment and even let him take a shower first. This way of telling the story can alert us to an issue between them. She feels the need to tell him that *she is not incompetent.* She seems to be worried Then, she tells him that she lost something information about the lost bracelet incident. She, then, tells him that she lost something else today:

W: Well, after I got home . . . after I got home from the store, after goin' to the Pizza Hut, I discovered it was gone. So I changed clothes and then I went lookin' for it . . . and posted up notices. And I, . . . Well you know that card I wrote Bryan, you know.
H: Uh hmm.
W: Well, a, I lost that today too.
H: Did you lose anything else? (7:43)

As the interaction unfolds it becomes clear that there are two repetitive patterns of emotions being expressed, namely, her fear of him followed by his contempt and her self-deprecation followed by both of them laughing at her incompetence. An example of this latter sequence occurs after the wife says that she has been benefiting from writing in her diary.

W: Because I know when you come from work at night you're tired and you don't like to hear me jabber, jibber jabber all the time (laughs).

Her husband then explains that, although he likes to hear her talk, she elaborates too much. He says:

H: . . . You talk too much.
W: Ya.
H: You over-elaborate sometimes.
W: Ya, I know. (14:47)

It is important to point out that, in practice, these temporal forms are generated by statistical analysis of the stream of codes of each interaction unit. They are discussed here in qualitative terms purely for introductory purposes. Specific procedures for discovering the temporal forms that characterize a stream of interaction can be found in Allison and Liker (1982), Gottman (1979, 1980), and Gottman and Ringland (1981).

Parenthetically, this study includes data on the couple's perception of their interaction in the video-recall sessions, measures of their behavior from the videotape, as well as an unusual and costly data set of their physiological reactions. It is very interesting to create a convergent picture of the interaction by using data from all domains. The table is a summary of the couple's self-report of their own affect in the video-recall session for the segment discussed above. Their continuous ratings are averaged over 10-second blocks; this was a requirement due to memory limitations of the laboratory computer we used. Thus, the time code refers to a

TABLE. SELF-REPORT OF OWN AFFECT DURING THE BEGINNING OF THE DISCUSSION ON THE DAY'S EVENTS

Time	Husband's Rating	Wife's Rating	Dialogue and Notes
5:00	4.6	4.2	
5:10	4.1	4.3	
5:20	4.4	3.4	
5:30	4.2	2.4	
5:40	4.5	2.4	W: Well, I lost it today.
5:50	3.8	2.4	She tells her story of how
6:00	4.0	2.2	hard she looked for the
6:10	4.0	2.1	bracelet and how she let
6:20	3.6	2.1	him take a shower first,
6:30	3.7	2.6	after straightening up.
6:40	3.8	4.3	W: Maybe I'll be lucky
6:50	3.8	3.7	since I pasted up notices....
7:00	3.6	2.4	
7:10	3.5	2.4	
7:20	3.8	1.9	
7:30	3.8	1.7	W: I lost that today,
7:40	3.6	3.9	too.
7:50	3.7	6.2	W: I don't think it was
8:00	4.0	4.3	my fault.
8:10	3.6	4.3	
8:20	3.7	2.7	W: Sometimes I'm
8:30	3.7	2.5	kinda absent-minded.
8:40	3.3	2.5	

10-second block; for example, 6:40 refers to the 10-second time block 6:40 to 6:49.

The first observation we can make from the Table is that the couple's own rating of their affect is congruent with the observers' coding of their behavior. It is possible to line up the dialogue and notes at critical intervals and observe major changes in self-ratings. For example, the wife's high rating of 4.3 at 6:40 corresponds to her statement that she may become lucky and recover the bracelet since she posted notices; her low rating of 1.7 at 7:30 corresponds to her admission that she also lost a card; and her high of 6.2 at 7:50 corresponds to her statement that she does not think it was her fault.

The physiological data provides more convergent information. For example, the variability in the wife's blood velocity is 1.80 seconds at one minute before she and her husband begin talking about how her day went (minute 2:20 to 3:20), when her self-rating is stable at 4.2; but from 4:50 to 5:50, when her self-ratings drop from 4.2 to 2.4, her blood velocity variability is 5.59 seconds. This increased variability is an index of greater sympathetic nervous system activity.

To summarize, Step One was an attempt to make concrete the notion of repeating probabilistic temporal forms in interaction. In this study we were interested in patterns of emotional expression and I suggested that we could identify two characteristic temporal patterns in this couple. Both patterns reveal the fact that the husband is dominant, distant and contemptuous of his wife's incompetence and that she is fearful, worried about his response, and self-deprecating. Other sources of information (e.g., self-report of their affect) converged to create a picture that these patterns of interaction are related to great upset and distress for the couple.

Step Two carries the process further, namely, toward using these temporal forms to discriminate couples along a criterion variable of interest; in this case, marital satisfaction.

Step Two: Discrimination Using Temporal Forms

In this second step toward making the discussion specific, I describe how the study of temporal forms in my research has led to a system for classifying couples purely in terms of their functional or dysfunctional patterns of interaction in resolving marital conflict. This section of the paper is a selected summary of some of the studies from Gottman (1979), which presented the results of a series of observational studies that focused primarily on couples' conflict resolution.

To reiterate, the goal of this step is to describe how the analysis of probabilistic temporal forms has been effective in accounting for variance in marital satisfaction. Whenever I say that two groups are different, I mean a statistically significant difference that has been replicated in at least two studies. The sequences of interaction were empirically derived. The most typical laboratory task I have used for the past eight years is for couples to discuss and try to resolve existing areas of disagreement in their marriages. Following an interview designed to build rapport with the experimenter, each couple is videotaped, the tape is transcribed verbatim and then coded by two groups of observers: one group codes each utterance's verbal content using one of 23 *content* codes that are later merged into eight summary codes; the other group codes *affect* using nonverbal behaviors of the speaker and of the listener with three summary codes, Positive, Neutral and Negative.

To summarize my results, I use the analogy of a chess game. A chess game has three phases—the beginning game, the middle game, and the end game—each having characteristic good and bad maneuvers and objectives. In fact, the objectives can be inductively derived from the maneuvers. The goal of the beginning phase is control of the center of the chessboard and development of position; the goal of the middle game is the favorable exchange of pieces; the goal of the end game is checkmate. Similarly, there are three phases in the discussion of a marital issue. The first phase is the *agenda-building phase.* The objective of this phase is to get the issues out as they are viewed by each person. The second phase is the *arguing phase*, and the goal is for partners to argue energetically for their points of view and for each partner to understand the areas of disagreement between them. The third phase is the *negotiation phase*, and its goal is compromise.

It is possible to discriminate the interaction of satisfied and dissatisfied couples in each phase. In the agenda-building phase, *cross-complaining* sequences characterize dissatisfied couples, while *validation* sequences char-

acterize satisfied couples. An example of a cross-complaining sequence is:

W: I've been home alone all day cooped up with the kids.
H: I come home tired and just want to relax.

An example of a validation sequence is:

W: I've been home alone all day.
H: Uh mmm.
W: Cooped up with the kids.
H: Yeah. I came home tired and just want to relax.
W: Uh huh.

In the negotiation phase, *counterproposal* sequences characterize the interaction of dissatisfied couples, while *contracting* sequences characterize the interaction of satisfied couples. An example of a counterproposal sequence is:

W: We spent all of Xmas at your mother's. This time let's spend it at my mother's.
H: Let's spend it at my mother's this year and next year we'll spend it at your mother's.

An example of a contracting sequence is:

W: We spent all of Xmas at your mother's. This time let's spend it at my mother's.
H: Yeah you're right, that's not fair. How about 50-50 this year?

In the middle, arguing phase, *without the use of the nonverbal codes, the two groups of couples would be indistinguishable.* The nonverbal codes differentiate the two groups throughout the interaction.

There were interesting negative results in our studies that disconfirmed cherished beliefs about the role of the quid pro quo (or positive reciprocity) and the role of metacommunication in discriminating the two kinds of marriages. Metacommunication is any comment about the *process* of communication (e.g., you're interrupting me). The quid pro quo hypothesis was simply wrong. It is the deescalation of negative affect and not the reciprocation of positive affect that discriminates the two groups. Metacommunication tends to be, what is called in Markov models theory, an *absorbing state* for dissatisfied couples; i.e., it becomes nearly impossible to exit once entered. For satisfied couples metacommunicative chains are brief and contain agreements that lead rapidly to other codes. An example of these metacommunicative sequences for satisfied couples is:

1. You're interrupting me.
2. Sorry, what were you saying?
3. I was saying we should take a vacation alone.

An example of these metacommunicative sequences for dissatisfied couples is:

1. You're interrupting me.
2. I wouldn't have to if I could get a word in edgewise.
1. Oh, now I talk too much. Maybe you'd like me never to say anything.
2. Be nice for a change.
1. Then you'd never have to listen to me, which you never do anyway.
2. If you'd say something instead of jibber jabbering all the time, maybe I'd listen.

and so on, *ad infinitum.*

In these results describing the differences in how satisfied and dissatisfied couples attempt to resolve a marital issue, a critical role is played by the *agreement codes.* In effect, satisfied couples continually intersperse various subcodes of agreement into their sequences. In the agenda-building phase, this is primarily a smile, nonverbal *assent* form of agreement, as in "Oh, yeah," "uh huh," "I see," and so on; while in the negotiation phase, this is primarily direct agreement or actually accepting the other's point of view and modifying one's own point of view. These listener responses have been called "back channeling" by Duncan and Fiske (1977). They are clear communications to the speaker that the listener is tracking; they can serve to regulate turns, but they are also more than that in the beginning phases of marital conflict resolution. They communicate not agreement with the speaker's point of view or *content*, but the idea that it might make some sense to see things the way the speaker does; that is, they communicate agreement with the speaker's *affect.* In this context, thus, they communicate a great deal. They "grease the wheels" for affective expression.

To summarize, I have suggested how, in Step One, it is possible to describe interaction using the notion of temporal form. In Step Two I have shown that temporal forms, empirically obtained, were powerful in a set of studies discriminating the problem solving of satisfied and dissatisfied couples. In fact, I have suggested that these patterns of interaction shed a great deal of light on theoretical concepts that have been extremely influential in the literature, although they were essentially untested assumptions.

I would like to continue this discussion by emphasizing that this description of temporal forms that discriminate along a criterion of interest can have powerful implications for the construction of theory. By the word "theory" I specifically mean attempts to explain observed pattern. This is the way theory is used in the physical sciences, i.e., attempts to explain a phenomenon. Description of temporal form can have implications for the development of theory.

One of the most consistent results I discovered is that it is the greater reciprocity of negative affect that characterizes dissatisfied couples and not, as the quid pro quo hypothesis suggests, the greater reciprocation of positive affect that characterizes satisfied couples. Why is this the case? Using analyses to describe temporal form, I found evidence for the fact that the husband's low emotional responsiveness to his wife is related to marital dissatisfaction. I tested this in a recent study (Gottman and Porterfield, 1981) in which spouses sent messages with fixed verbal content to their partners (e.g., "I'm cold, aren't you?"). These messages could have one of three meanings depending on their nonverbal delivery—e.g., (a) turn up the heat; (b) I'm requesting information; or (c) I want to snuggle. By having the messages received by both partners and strangers, we could determine if there was a deficit in nonverbal communication in dissatisfied couples and, if so, whether it was a listener or a receiver deficit. The results showed evidence for a deficit in communication in dissatisfied couples, and it was the husband's deficit as a receiver. With Australian couples Noller (1980) independently conducted nearly the identical study and got exactly the same results.

I outlined these results for the following methodological reasons. First, given the stability of these findings, it is now possible to look for specific sequences that are characteristic of good problem solving or diagnostic of communicative problems (see also Gottman, 1979: chapter 9); thus, we discovered specific temporal forms that *characterized relationships* that are functioning well and specific forms that characterized relationships functioning poorly (in terms of relationship satisfaction). Second, it is now possible to begin constructing *theory*, in the sense in which I use that term, i.e., *explanation for observed patterns that account for variance in a criterion of interest* (in this case the variable is marital satisfaction).

CONCLUSION

This paper has suggested that recent methodological breakthroughs represent far more than new analytic tools in a rapidly escalating arsenal of research tools. A specific set of breakthroughs represent, I believe, a *conceptual revolution* in our ability to think about relationships. I proposed an approach to this task in my discussion of temporal form. I also suggested that a complete measurement network in the study of family interaction ought to consist of observational category systems, the description of affective patterns, and the perception of interaction (perhaps as tapped by social exchange theory). I would like to end with a discussion of film making, which I have found is an extremely useful metaphor in answering the question of what to measure. Consider, for a moment, a film of a crucial moment in a baseball game. It is the bottom of the ninth inning, the bases are loaded and one team's star pitcher faces the other team's batter, a man who many say is on the way out. How is this important moment filmed? First, we see the tension of the batter. A close-up establishes his fear. A few shots between the pitcher and the catcher show us that they are confident they have the perfect strategy. The pitcher now appears confident. We see the reaction shots of the batter. He is tense, nervous, uncertain. We see the pitch. Strike one. Now the batter's confidence erodes, the tension mounts. The next pitch. Strike two. Now we see the batter suddenly spotting his wife in the audience. She is with him, supporting him. The batter experiences a resurgence of hope. The pitcher is not overly confident. The pitch is slow and wide. The batter steps toward the ball and hits a home run.

How was this all conveyed by the film? The action was carefully edited with the right combinations of extreme long shots, close-ups, extreme close-ups, re-establishing shots, reaction shots, and so on. The effect is that we, the audience, see not only a sequence of actions, but a *sequence of actions, cognitions, and affects*. This sequence is precisely the one that tells the story. I would argue that that is the key to what should be measured in describing relationship: temporal forms and their associated patterns of cognitions and affects.

FOOTNOTE

1. Proxemics is the study of the human use of physical space. An example is the modal personal space between people in different cultures.

REFERENCES

Abelson, R.
1976 "Script processing in attitude formation and decision making." In J. S. Carroll and J. Payne (Eds.), Cognition and Social Behavior. Hillsdale, NJ:Erlbaum Associates, 1976.

Ackerman, N. W.
1937 "The family as a special and emotional unit." Bulletin of the Kansas Mental Hygiene Society 12:1-8.
1954 "The diagnosis of neurotic marital interaction." Social Casework 35:139-147.

Ackerman, N. W. and Sobel, R.
1950 "Family diagnosis: an approach to the study of the pre-school child" American Journal of Orthopsychiatry 20:744-752.

Alexander, J. F.
1973a "Defensive and supportive communications in family systems." Journal of Marriage and the Family 35:613-617.
1973b "Defensive and supportive communication in normal and deviant families." Consulting and Clinical Psychology 40:223-231.

Allison, P. D. and Liker, J. K.
1982 "Analyzing sequential categorical data on dyadic interaction: a comment on Gottman." Psychological Bulletin 91:393-403.

Bales, R. F.
1950 Interaction Process Analysis. Cambridge, MA: Addison-Wesley.

Bateson, C.
1966 "Critical evaluations." International Journal of Psychiatry 2:415-417.

Bateson, G., Jackson, D. D., Haley, J. and Weakland, J.
1956 "Toward a theory of schizophrenia." Behavioral Science 1:251-264.

Beels, C. and Ferber, A.
1969 "Family therapy: a view." Family Process 8: 208-317.

Birchler, G., Weiss, R. and Vincent, J.
1975 "Multimethod analysis of social reinforcement exchange between maritally distressed and nondistressed spouse and stranger dyads." Journal of Personality and Social Psychology 31: 349-360.

Bruner, J. S., Goodnow, J. J. and Austin, G.
1962 A Study of Thinking. New York:Wiley.

Bruner, J. S. and Tagiuri, R.
1954 "The perception of people." In G. Lindzey (Ed.), Handbook of Social Psychology (Vol.2). Reading, MA:Addison-Wesley.

Burchinal, L. G., Hawkes, G. R. and Gardner, B.
1957 "Marriage adjustment, personality characteristics of parents and the personality adjustment of their children." Marriage and Family Living 17:366-372.

Burgess, E. W.
1939 "Predictive factors in the success or failure of marriage." Marriage and Family Living 1:1-3.

Burgess, E. W. and Cottrell, L. S.
1939 Predicting Success or Failure in Marriage. New York:Prentice Hall.

Burgess, E. W., Locke, H. J. and Thomes, M. M.
1971 The Family. New York:Van Nostrand Reinhold

Burgess, E. W. and Wallin, P.
1953 Engagement and Marriage. Chicago: J. B. Lippincott.

Caputo, D. V.
1963 "The parents of schizophrenics. Family Process 2:339-356.

Chance, M. R. A. and Jolly, C.
1970 Social Groups of Monkeys, Apes, and Men. New York:Dutton.

Cheek, F. E.
1964 "The "schizophrenogenic" mother in word and deed." Family Process 3:155-177.

Chevalier-Skolnikoff, S.
1973 "Facial expression of emotion in nonhuman primates." In P. Ekman (Ed.), Darwin and Facial Expression: A Century of Research in Review. New York:Academic Press.

Darwin, C.
1872 The Expression of the Emotions in Man and Animals. London:John Murray.

Dean, D. G.
1966 "Emotional maturity and marital adjustment." Journal of Marriage and the Family 28(4): 454-457.

Duncan, S. D., Jr.
1969 "Nonverbal communication." Psychological Bulletin 72:118-137.

Duncan, S. D., Jr. and Fiske, D. W.
1977 Face-to-face Interaction: Research, Methods, and Theory. Hillsdale, NJ:Lawrence Erlbaum Associates.

Editorial policy statement.
1962 Family Process 1(March):2.

Einstein, A. and Infeld, L.
1938 The Evolution of Physics. New York: Simon and Schuster.

Ekman, P.
1971 "Universals and cultural differences in facial expressions of emotion." Presented at the Nebraska Symposium on Motivation.
1979 "About brows: emotional and conversational signals." In M. von Cranach, K. Foppa, W. Lepenies, and D. Ploog (Eds.), Human Ethnology. Cambridge, England:Cambridge University Press.
1982 "Methods for measuring facial action." In K. R. Scherer and P. Ekman (Eds.), Handbook of Methods in Nonverbal Behavior Research. New York:Cambridge University Press.

Ekman, P. and Friesen, W. F.
1978 Facial Action Coding System. Palo Alto,CA:

Consulting Psychologists Press.
Ekman, P., Friesen, W. V. and Ellsworth, P.
1972 Emotion in the Human Face. New York: Pergamon Press.
Ekman, P. and Oster, H.
1979 "Facial expressions of emotion." Annual Review of Psychology 30:527-554.
Ervin-Tripp, S.
1977 "Wait for me, roller skate." In S. Ervin-Tripp and C. Mitchell-Kernan (Eds.) Child Discourse. New York:Academic Press.
Forbes, D. and Lubin, D.
1979 "Reasoning and behavior in children's friendly interactions." Presented at the meeting of the American Psychological Association, New York.
Friesen, W. V.
1972 Cultural Differences in Facial Expressions in a Social Situation: An Experimental Test of the Concept of Display Rules. Unpublished doctoral thesis, University of California, San Francisco.
Garvey, C.
1974 "Some properties of social play." Merrill-Palmer Quarterly 20:163-180.
Garvey, C. and Hogan R.
1973 "Social speech and social interaction: egocentrism revisited." Child Development 44: 562-568.
Glick, J.
1978 "Cognition and social cognition: an introduction." In J. Glick and K. Alison Clarke-Stewart (Eds.), The Development of Social Understanding. New York:Gardner Press.
Gottman, J. M.
1979 Marital Interaction: Experimental Investigation. New York:Academic Press.
1980 "Analyzing for sequential connection and assessing interobserver reliability for the sequential analysis of observational data." Behavioral Assessment 2:361-368.
1981 Time-series Analysis: A Comprehensive Introduction for Social Scientists. New York:Cambridge University Press.
Gottman, J. and Bakeman, R.
1979 "The sequential analysis of observational data." In M. Lamb, S. Soumi and G. Stephenson (Eds.), Social Interaction Analysis. Madison: University of Wisconsin Press.
Gottman, J. M. and Porterfield, A. L.
1981 "Communicative competence in the nonverbal behavior of married couples." Journal of Marriage and the Family 43(November):817-824.
Gottman, J. M. and Ringland, J. T.
1981 "The analysis of dominance and bidirectionality in social development." Child Development 52:393-412.
Haley, J.
1964 "Research on family patterns: an instrument measurement." Family Process 3:41-65.
1967 "Speech sequences of normal and abnormal families with two children present. Family Process 6:81-97.
Hall, J. and Williams, M. S.
1966 "A comparison of decision-making performances in established and ad hoc groups. Journal of Personality and Social Psychology 3: 214-222.
Harper, R. G., Wiens, A. N. and Matarazzo, J. G.
1978 Nonverbal Communication: The State of the Art. New York:John Wiley and Sons.
Hetherington, E. M. and Martin, B.
1972 "Family interaction and psychopathology in children." In H. C. Quay and J. S. Werry (Eds.), Psychopathological Disorders of Childhood. New York:John Wiley and Sons.
Hill, R. and Hansen, D. A.
1960 "The identification of conceptual frameworks utilized in family study." Marriage and Family Living 22:299-311.
Hops, H., Wills, T. A., Patterson, G. R. and Weiss, R. L.
1972 "The marital interaction coding system (MICS)." Unpublished manuscript, University of Oregon.
Izard, C. E.
1971 The Face of Emotion. New York:Appleton-Century-Crofts.
Jackson, D. D.
1965 "Family rules: marital quid pro quo." Archives of General Psychiatry 12:1535-1541.
Jacob, T.
1975 "Family interaction in disturbed and normal families: a methodological and substantive review." Psychological Bulletin 82:33-65.
Jacobson, N. S.
1977 "Problem solving and contingency contracting in the treatment of marital discord." Journal of Consulting and Clinical Psychology 45:92-100.
Jacobson, N. S. and Martin, B.
1976 "Behavioral marriage therapy: current status." Psychological Bulletin 83(4):540-556.
Kelley, H. H.
1979 Personal Relationships: Their Structure and Processes. New York:Lawrence Erlbaum.
Kendon, A.
1967 "Some functions of gaze direction in social interaction." Acta Psychologica 26:1-47.
Knapp, M. L.
1972 Nonverbal Communication in Human Interaction. New York:Holt, Rinehart and Winston
Labov, W. and Fanchel, D.
1977 Therapeutic Discourse. New York:Academic Press.
Laing, R. D., Phillipson, H. and Lee, A. R.
1966 Interpersonal Perception. London:Tavistock.
Landis, C.
1924 "Studies of emotional reactions: II. general behavior and social expression." Journal of Comparative Psychology 4:447-509.
1929 "The interpretation of facial expression in emotion." Journal of General Psychology 2:59-72.
Leary, T.
1956 Multilevel Measurement of Interpersonal Behavior. Berkeley, CA:Psychological Consultation Service.

1957 Interpersonal Diagnosis of Personality. New York:Ronald Press.

Lederer, W. J. and Jackson, D. D.
1968 The Mirages of Marriages. New York:W. W. Norton.

Leik, R. K.
1963 "Instrumentality and emotionality in family interaction." Sociometry 26:131-145.

Locke, H. J. and Wallace, K. M.
1959 "Short marital adjustment and prediction tests: their reliability and validity." Marriage and Family Living 21:251-255.

Mahl, G. F.
1956 "Disturbances and silences in the patient's speech in psychotherapy." Journal of Abnormal Social Psychology 53:1-15.

Markman, H. J.
1981 Prediction of marital distress: a 5-year follow up. Journal of Consulting and Clinical Psychology 49:760-762.

Mishler, E. G. and Waxler, N. E.
1966 "Family interaction processes and schizophrenia: a review of current theories." International Journal of Psychiatry 2:375-415.
1968 Interaction in Families: An Experimental Study of Family Process in Schizophrenia. New York: Wiley.

Nisbett, R. E., Borgida, E., Crandall, R. and Reed, H.
1976 "Popular induction: information is not necessarily informative. In J. S. Carroll and J. W. Payne (Eds.), Cognition and Social Behavior. Hillsdale, NJ:Erlbaum Associates.

Noller, P.
1980 Marital Misunderstandings: A Study of Couples' Non-verbal Communication. Doctoral dissertation, University of Queensland, Australia.

Obrist, P. A., Lawler, J. E., Howard, J. L., Smithson, K. W., Martin, D. L. and Manning, J.
1974 "Sympathetic influences on cardiac rate and contractility during acute stress in humans." Psychophysiology 11:405-427.

Obrist, P. A., Webb, R. A., Sutterer, J. R. and Howard, J. L.
1970 "The cardiac somatic relationship: some reformulations." Psychophysiology 6:569-587.

Olson, D. H.
1972 "Empirically unbinding the double-bind: review of research and conceptual reformulations." Family Process 11:69-94.

Osgood, C. E., Suci, G. J. and Tannenbaum, P. H.
1957 The Measurement of Meaning. Urbana:University of Illinois Press.

Patterson, G. R., Hops, H. and Weiss, R. L.
1975 "Interpersonal skills training for couples in early stages of conflict." Journal of Marriage and the Family 37:295-303.

Patterson, G. R. and Moore, D.
1979 "Interactive patterns as units of behavior." In M. E. Lamb, S. J. Soumi and G. R. Stephenson (Eds.), Social Interaction Analysis. Madison, WI:University of Wisconsin Press.

Patterson, G. R., Ray, R. S. , Shaw, D. A. and Cobb, J. A.
1969 Manual for Coding of Family Interactions. Document No. 01234. Order from ASIS/NAPS, Microfiche Publications, 440 Park Avenue South, New York, NY 10016.

Raush, H. L., Barry, W. A., Hertel, R. K. and Swain, M. A.
1974 Communication, Conflict, and Marriage. San Francisco:Jossey-Bass.

Reid, J. B.
1967 Reciprocity and Family Interaction. Unpublished doctoral dissertation, University of Oregon, Eugene, OR.

Riskin, J. and Faunce, E. E.
1970 "Family interaction scales, III. discussion of methodology and substantive findings." Archives of General Psychiatry 22:527-537.

Rubenstein, L. and Cameron, D. E.
1968 "Electronic analysis of nonverbal communication." Comprehensive Psychiatry 9:200-208.

Ryder, R. G.
1968 "Husband-wife dyads versus married strangers." Family Process 7:233-238.

Sackett, G. P.
1980 "Lag sequential analysis as a data reduction technique in social interaction research." In D. B. Sawin, R. C. Hawkins, L. O. Walker and J. H. Penticuff (Eds.), Exceptional Infant (Vol. 4). New York:Brunner-Mazel.

Schaffer, H. R.
1977 "Early interactive development." In H. R. Schaffer (Ed.), Studies in Mother-infant Interaction. London:Academic Press.

Schank, R. and Abelson, R.
1977 Scripts, Plans, Goals and Understanding: An Inquiry into Human Knowledge Structure. Hillsdale,NJ:Erlbaum Associates.

Scherer, K. R.
1974 "Acoustic concomitants of emotional dimensions: judging affect from synthesized tone sequences. In S. Weitz (Ed.), Nonverbal Communication: Readings with Commentary. New York:Oxford University Press.
1979 "Personality markers in speech." In K. R. Scherer and H. Gilen (Eds.), Social Markers in Speech. Cambridge, England:Cambridge University Press.
1982 "Methods of research on vocal communication: paradigms and parameters." In K. R. Scherer and P. Ekman (Eds.), Handbook of Methods in Nonverbal Behavior Research. New York: Cambridge University Press.

Scherer, K. R. and Ekman, P.
1982 Handbook of Methods in Nonverbal Behavior Research. New York:Cambridge University Press.

Shannon, C. E.
1949 "The mathematical theory of communication." In C. E. Shannon and W. Weaver (Eds.), The Mathematical Theory of Communication. Urbana:University of Illinois Press.

Stern, D.
1974 The First Relationship: Infant and Mother. Cambridge,MA:Harvard University Press.

Strodtbeck, F. L.
1951 "Husband-wife interaction over revealed differences." American Sociological Review 16: 468-473.
Stuart, R. B.
1969 "Operant-interpersonal treatment for marital discord." Journal of Consulting and Clinical Psychology 33:675-682.
Terman, L. M., Buttenweiser, P., Ferguson, L. W., Johnson W. B. and Wilson, D. P.
1938 Psychological Factors in Marital Happiness. New York:McGraw Hill.
Thibaut, J. W. and Kelley, H. H.
1959 The Social Psychology of Groups. New York: Wiley.
Vandell, D. L. and Mueller, E. C.
1980 "Peer play and friendship during the first two years." In H. C. Foot, A. J. Chapman and J. R. Smith (Eds.), Friendship and Social Relations in Children. New York:Wiley.
Von Cranach, M. and Vine, I. (Eds.)
1973 Social Communication and Movement. New York: Academic Press.
Watzlawick, P., Beavin, J. H. and Jackson, D. D.
1967 Pragmatics of Human Communication: A Study of Interactional Patterns, Pathologies, and Paradoxes. New York:W. W. Norton.
Waxler, N. E. and Mishler, E. G.
1970 "Sequential patterning in family interaction: a methodological note." Family Process 9: 211-220.
Weiss, R., Birchler, G. and Vincent, J.
1974 "Contractual models for negotiation training in marital dyads." Journal of Marriage and the Family 36:1-11.
Weiss, R. L., Hops, H. and Patterson, G. R.
1973 "A framework for conceptualizing marital conflict: a technology for altering it, some data for evaluating it." In L. A. Hamerlynch, I. E. Handy and E. J. Mash (Eds.), Behavior Change: The Fourth Banff Conference on Behavior Modification. Champaign, IL:Research Press.
Williams, E. A. and Gottman, J. M.
1981 A User's Guide to the Gottman-Williams Time-Series Computer Programs for Social Scientists. New York:Cambridge University Press.
Wills, T. A., Weiss, R. L. and Patterson, G. R.
1974 "A behavior analysis of the determinants of marital satisfaction." Journal of Consulting and Clinical Psychology 42:802-811.
Wilson, E. O.
1975 Sociobiology: The New Synthesis. Cambridge, MA:Harvard University Press.
Winter, F., Ferreira, A. and Bowers, N.
1973 "Decision-making in married and unrelated couples." Family Process 12:83-94.