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Full Name of Author — Nom complet de l'auteur

James Martin White

Date of Birth — Date de naissance

Feb 22 1946

Country of Birth — Lieu de naissance

USA - CAN citizen

Permanent Address — Résidence fixe

Dept. of Sociology
University of Calgary
Calgary Alberta

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Name of Supervisor — Nom du directeur de thèse

Lyle Larson

Date

Feb 19 1980

Signature

James M. White

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THE UNIVERSITY OF ALBERTA

A MODEL OF INTERPERSONAL PERCEPTION AND COMMUNICATION IN THE DYAD

by

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF DOCTOR OF PHILOSOPHY

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FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "A Model of Interpersonal Perception and Communication in the Dyad," submitted by James M. White in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Family.

Lyle E. Larson

Lyle Larson, Supervisor

Michael W. Gillespie

Mike Gillespie

Charles W. Hobart

Charles Hobart

Richard Jung

Richard Jung

J. Montgomery

Jason Montgomery

John Peters

John Peters
External Examiner

Date October 5, 1979

DEDICATION

TO SHIRL AND BOB

This study reviews the extant literature on interpersonal perception and communication in marriage and the family. In the area of interpersonal perception two theoretical frameworks dominate the research. One framework is that proposed by Laing, Phillipson and Lee (1966). These authors develop a method by which interpersonal agreement, understanding and realization can be measured by comparing the questionnaire responses of one respondent to the responses of another. The second theoretical framework in the area of interpersonal perception is Balance Theory. This framework has been developed by Heider (1958) for individuals and for dyads by Newcomb (1961). It has been formalized as Graph Theory by Cartwright and Harary (1956) and Flament (1963).

The research in the area of communication in marriage and the family is dominated by a communication systems approach. Although much of the literature cites the particular framework of Communication Theory (Shannon, 1949), no thorough application of this approach has been undertaken in the area of marital and family communication.

The model developed in this study ties together the two theoretical frameworks to interpersonal perception by the formal technique of Graph Theory. Each individual is represented by a triangular graph whose sides correspond to one's view of an issue, one's view of the other's view of the issue, and the affect that one feels for the other. These two individual graphs are multiplied to yield a graph of the relationship. The set of all possible dyadic graphs is partitioned according to three axioms, i.e., balance, positivity, and least cost. The axioms of positivity and balance imply that the process is an equilibrating system ending in a final "absorbing" state. The axiom of

From this partitioning of possible states of dyadic graphs the analytic transition probabilities are deduced. These are the transition probabilities of a finite state, absorbing Markov chain model.

The Markov model is further interpreted as a model of information transmission following Communication Theory. The receiver of a message only receives information if there is a change in interpersonal perception. Hence, the Markov model is interpreted as a process of reduction of uncertainty as the process approaches complete interpersonal understanding of certainty.

The model is applied to two case studies. The application of the model to case studies is not undertaken to test the model since it is a stochastic model and demands a large sample size. Rather, the model is demonstrated to be empirically operationalized, subject to goodness-of-fit testing, and to serve an interpretive function. The model is applied to a play by Neil Simon and a video tape of marital interaction. Anomalies are noted and discussed. It is concluded that the model is sufficiently supported to warrant application to a larger data base.

In conclusion, the model is viewed as offering a technique for the topographical analyses of marital communication both in research and counselling. A definitive testing of the model awaits further research.

ACKNOWLEDGEMENTS

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LIST OF FIGURES

CHAPTER I

INTRODUCTION

The dyad is the minimal social group. It is the building block of families as well as larger social groupings. The interaction between two people is, at minimum, composed of a channel of communication between them. In fact, if there is no communication between two people then there is no interaction and no dyad. When communication is present, it is supposed that messages are sent and received by both parties. Further, it is likely that one person sends a message to the other based on the perceptions they have of the other person, as well as the information they wish to communicate. If all other variables are excluded, the dyadic relationship is based on the interpersonal communication and interpersonal perception between two people. Each message that one receives might change the person's perception of the other and, hence, change the direction and intention of the next message. It is in this sense that the dyad can be viewed as a system of variables where a variable at one time eventually influences itself at some later time. For instance, if a wife perceived her husband's housework patterns as being less than satisfactory, and communicates this to the husband and, subsequently, the husband makes changes; then the perception of the wife should in turn be affected by these changes. Hence, the system of influences eventually returns to the variable of the wife's perception. Therefore, the dyad can be viewed as a system of interpersonal perception and communication.

The purpose of this monograph is to propose and explicate a formal model of interpersonal perception and communication in the dyadic system.

In particular, the focus of this analysis is on the marital dyad though the work is equally applicable to other dyadic relationships. However, the marital dyad is oftentimes the longest-lasting dyadic association, other than those based on consanguine ties. Unlike consanguine ties, marital ties are chosen and can be repudiated like most other dyadic relationships. Thus, the marital dyad serves as a focus and example of interpersonal perception and communication in the dyadic system.

A formal model of the dyadic system is very different from a theory. A theory seeks to explain by deducing from a set of propositions, including some lawlike propositions, the outcome of an event which is empirically measurable. A formal model acts as an analogy to the phenomenon it models. That is, a model is similar to the phenomenon in some respects but not in others. For instance, the proposed formal model of dyadic interpersonal perception and communication is a closed system model which does not take into account interactions other than those in the dyad, nor influences from economic, political or other exogenous systems. There is certainly no married couple which is not influenced by these exogenous variables. Hence, the closed system model is only, to a certain extent, similar to real life married couples. The analysis of the goodness of fit of the model to some data set simply reveals the extent to which this analogy is a reasonable approximation. Theories can be disconfirmed, whereas a model only offers a partial perspective and insight into a phenomenon.

The utility of a formal model is in its contribution to the development of theory. A formal model that reveals even the poorest of fits to empirical data, nonetheless allows for the systematic evaluation of this particular perspective. The insights gained might be in a different direction from those of the model; however, these insights are possible because of the systematic and precise statements offered by the formal model. On the other hand, a formal model that "fits" data consistently well may be incorporated into a theory. Hence, the rationale for the construction of formal models is that they aid the development of systematic theory.

A further, more short-range benefit of formal models is in the area of forecasting and projection. For example, if a model "fits" a data set well at this time, the model may be used to project the values of the set at some later time. Such forecasting, though not prediction, may eventually offer insights into the processes which in the end could culminate in theory. In the short term, some forecasting techniques might be of benefit in marriage and family counselling as they have proved to benefit weather forecasting and decisions based on demographic forecasts.

The organization of this work is to first review the extant theoretical and empirical literature in the area of interpersonal perception in marriage and families. Chapter II reviews this material. Chapter III reviews the work, both theoretical and empirical, which has been done in family communication. Since some of these authors suggest the theoretical approach of communications theory, this is examined in Chapter IV. Chapter V presents the model for interpersonal perception and communication. Chapter VI pursues some of the methodological and measurement issues which confront an application of the model. Chapter VII is an application of the model to two sets of data; one from the Neil Simon play *Plaza Suite*, the other from a case study of a married couple. This application serves three purposes: it illustrates how the model is operationalized; it shows how the model might be used to interpret dyadic interaction; and it demonstrates some of the ways in which the fit of the model may be assessed. Lastly, Chapter VIII explores some of the implications of the model for research and other areas.

CHAPTER II

INTERPERSONAL PERCEPTION IN FAMILIES

The importance of interpersonal perception in the study of the family derives from the assumption that human actors respond to their map of the world, and not necessarily to the actual object and events in the world. This perspective has received many similar formulations in such diverse fields as semantics (Hayakawa), sociology (Thomas), and philosophy (Wittgenstein). In the study of the family, the old-perspective that family perception, is relatively homogeneous has been supplanted by the realization that there is great diversity within families (Larson, 1974a). The change of perspectives in family studies from the assumption of perceptual homogeneity to heterogeneity has been due to the increased interest in the theory of interpersonal perception, as well as the emergence of empirical findings which flatly contradict the old assumption of attitudinal and perceptual homogeneity.

The following sections review the two major theoretical approaches to the study of interpersonal perception in the family and the empirical research in this area. Both of the theoretical perspectives make some distinction in regard to levels of perception. Since this is at least a partially shared framework, it is utilized to order the review of empirical research so that the empirical findings may reflect on the empirical adequacy of both theoretical perspectives.

2.1 Theoretical Perspectives

Two theoretical perspectives on interpersonal perception in families have emerged. The theoretical perspective represented by Laing, Phillipson and Lee (1966) is directly applicable to the study of marital dyads, and is expandable to larger family units. The second theoretical perspective, balance theory, gained popularity in social psychology and emerged in the study of families as a borrowed paradigm. The format of this review is to outline the basic position of each of these two theoretical perspectives, and then to compare the two.

2.1a Laing, Phillipson and Lee (1966) introduce a technique by which interpersonal perception may be studied. Their technique follows much of the social psychological research on interpersonal agreement and perceived agreement. However, Laing and his associates go much farther than their social psychological predecessors in that they present an instrument for assessing levels of perception, identify salient issues in the relationship, and specify the theoretical significance of comparisons between perceptual levels.

The technique which Laing, Phillipson and Lee (1966) propose is called the Interpersonal Perception Method (IPM). The IPM identifies 60 salient issues in relationships. The relationship in a dyad is the unit of analysis. However, for each issue four viewpoints exist. For instance, the issue of respect (#12) is approached from the four perspectives of person H's respect for W, person W's respect for H, person H's respect for H, and person W's respect for W. Thus, in the dyad there are four relations; two interperson relations and two intraperson or self-reflexive relations. These four relations for each of the 60 issues compose the 240 issue statements of the IPM.

The IPM records individual responses to the degree of truthfulness for each of the issue statements on three perceptual levels. These three levels are the direct perspective, metaperspective and meta-metaperspective. The direct perspective on an issue statement is the degree of truthfulness the respondent assigns to that statement. The metaperspective is the degree of truthfulness the respondent assigns to the statement of the other's direct perspective on the issue. And the meta-metaperspective is the truth value the respondent assigns to the metaperspective of the other member of the dyad.

The three levels of perception can be more clearly expressed with the aid of a diagram. Suppose that the members of the dyad are a husband and wife. The four relations, then, are the husband's relation to wife (HW), the wife's relation to husband (WH), the husband's relation to self (HH), and the wife's relation to self (WW). The direct perspective of the husband for the issue relation of the wife's relation to husband (WH) is given by the notation H----→ (WH). If the issue is respect, then this notation is interpreted as the truth value the husband assigns to the statement that his wife thinks that she respects him. In terms of the notation, the metaperspective of the husband is expressed as H----→ W----→ (WH). The meta-metaperspective is the truth value the husband assigns to the statement that his wife thinks that he thinks she respects him. Notationally, this is expressed as H----→ W----→ H----→ (WH). For both members of the dyad, the three levels of perception on any one issue statement are expressed as the notation H----→ W----→ H----→ (WH) ←----W ←----H ←----W.

Each respondent is asked to evaluate the statements as to their truth value. Laing, Phillipson and Lee (1966) use a four-valued truth function so that responses range from very true (++), slightly true (+), slightly untrue (-), to very untrue (--). The following questions are drawn from the IPM. The issue is the relation of love. The respondent in this case is the husband or "He" member of the dyad:

15. A. How true do you think the following are?

1. She loves me. H----→ (WH)
2. I love her. H----→ (HW)
3. She loves herself. H----→ (WW)
4. I love myself. H----→ (HH)

B. How would SHE answer the following:

1. "I love him." H----→ W----→ (WH)
2. "He loves me." H----→ W----→ (HW)
3. "I love myself." H----→ W----→ (WW)
4. "He loves himself." H----→ W----→ (HH)

C. How would SHE think you have answered the following?

1. She loves me. H----→ W----→ H----→ (WH)
2. I love her. H----→ W----→ H----→ (HW)
3. She loves herself. H----→ W----→ H----→ (WW)
4. I love myself. H----→ W----→ H----→ (HH)

(Laing, Phillipson and Lee, 1966:152).

The notation at the left shows the issue relation and perceptual level of each question. The four statements in 15A are the direct perspective of the husband. The questions in 15B are the metaperspective of the husband and the questions in 15C are the meta-metaperspective of the husband for the four relations on the issue of love.

It is one function of the IPM to supply the researcher with a profile of one person's perceptions of the relationship. Although such a profile may be useful in some research contexts, the focus of Laing, Phillipson and Lee (1966) is on the comparison of the levels of perception between dyad members. The three comparisons that receive the preponderance of attention from Laing and his associates (1966) are agreement, understanding, and realization. Agreement is the matching of two direct perspectives on the same issue. For instance, if the wife thinks it is true that her husband loves her, and the husband thinks that he loves her, then there is a complete conjunction of the two views and agreement. Understanding is the comparison of one person's direct perspective with the other person's metaperspective. In terms of the notation, understanding or misunderstanding is the comparison of H----→ (X) with W----→ H----→ (X) [where (X) is the issue relation]. The comparison of realization is the conjunction or disjunction of one person's metaperspective with the other person's meta-metaperspective. Notationally, this is expressed as H----→ W----→ (X) with W----→ H----→ W----→ (X).

In addition to these comparisons of perspectives held by both members of the dyad, Laing, Phillipson and Lee (1966) also compare one person's direct perspective with that same person's meta-metaperspective. In other words, this can be expressed in the notation where H----→ (X) is compared with H----→ W----→ H----→ (X). According to Laing and his associates (1966), this comparison gives the individual the *feeling* of being understood or misunderstood.

These comparisons--the three interpersonal and one intrapersonal--can describe various states of a dyadic relationship. For instance, a dyad can be described as exhibiting agreement, understanding, realization and the bilateral feeling of being understood. Laing, Phillipson and Lee (1966) present a typology of all the possible IPM profiles for the three interpersonal comparisons. This typology can be used to describe the relationship in a dyad at one point in time, and trace the changes in the relationship from one time to another.

Although Laing and his associates view the IPM as a descriptive device, they also realize that there are many theoretical assumptions behind their measurement technique. Some of these theoretical assumptions are only implicit in their formulation. However, one explicit assertion is "In a science of persons, we state as axiomatic that: 1.

behaviour is a function of experience; 2. both experience and behaviour are always in relation to some one or something other than self" (Laing, Phillipson and Lee, 1966:9). This statement posits that the minimal unit of analysis in social science is the relationship and not an isolated individual. Furthermore, Laing, Phillipson and Lee assert that to understand the behavior of one person, an analysis must examine two persons and a common situation. The relationship must be analyzed not just in terms of interaction but in terms of interexperience as well.

Laing, Phillipson and Lee view dyadic relationships as composed of interactions and interexperience. Their attention, however, is directed to the notion of interexperience, and the notion of interaction is only considered in light of interexperience. The assumption behind their focus on interexperience seems to be that, in terms of behavior, what a person thinks was said or done is far more explanatory than what was actually said or done. Rather, the next behavior or interaction will not be a direct function of the previous behavior or interaction but the result of how that previous interaction or behavior is perceived and experienced by the actors. The degree to which the members of a dyad interpret their experience similarly indicates the degree of agreement, understanding and realization in the relationship. Hence, the interpersonal perceptual conjunctions and disjunctions measured by the IPM reflect the state of the interexperience in the relationship. It is the idea of interexperience, and not just individual experience, that Laing and his associates believe to be explanatory.

Regardless of the implicit theory that dyadic interexperience will explain dyadic interaction, Laing and his associates fail to explicitly formulate the relation between agreement, understanding and realization with behavior in the dyad. The dyadic relationship might be in a state of disagreement, misunderstanding and failure of realization; however, knowing this state of the relationship yields little information from a theoretical and predictive perspective. Rather, Laing, Phillipson and Lee (1966:131) suggest that "The method appears to have most value when the system properties of the dyad are correlated with the behaviour and experience of the agents who comprise it." In other words, they are suggesting the typological use of the IPM. This limitation of their work is only necessary because these authors have not fully articulated their theoretical view of dyadic interexperience with some system of dependent variables. Hence, Laing, Phillipson and Lee view the utility of their theory and method (IPM) as being the description of various relationships.

Scheff (1967) proposes that the IPM be used in the measurement of consensus. He defines consensus as ". . . an infinite series of reciprocating understandings between the members of a group" (Scheff, 1967:45). Thus, consensus on an issue is where members agree on the issue, and agree that they agree, and agree that they agree that they agree, and so on, ad infinitum. The parallel with Laing and his associates is very close. However, whereas Laing, Phillipson and Lee deal only with the three levels of perception, Scheff willingly speculates about deeper levels. He views these perceptual levels, or what he calls coorientation, as producing the degree of coordination in the group. The task and the coordination which is needed for its performance determines the degree of consensus needed in the group. Scheff (1967:41) states this proposition as follows: "*The type and extent of consensus is dependent on the type and extent of coordination required between the* *members of the group.* This proposition leads us back to the social-psychological bases of coordination, which are communication and consensus [emphasis in original]."

Scheff views consensus or coorientation as being linked to coordination and communication. If a task requires group coordination, then coorientation will be forthcoming as long as the communication facilitates this process. In other words, coorientation or consensus depends on communication. Also, consensus leads to communication which facilitates coordination of group activities.

Klein (1976) proposes that Scheff's theory of coorientation be adapted to the study of marital relationships. Certainly, Scheff's methods for assessing coorientation are no more superior than those proposed by Laing and his associates. The utility of borrowing the Scheff formulation would seem to be that Scheff offers a system of theoretically linked concepts. That is, in the Scheff proposal consensus predicts coordination when communication is kept constant. Whereas Laing, Phillipson and Lee offered a measurement typology, Scheff offers the rudiments of a theory.

The problem with Scheff's formulation is simply that it is at a rudimentary stage of development. Scheff (1967) and Klein (1976) do not specify the variables in communication and coordination beyond a few suggestive comments. However, Scheff can be credited with advancing the theory of interpersonal perception to the stage where the conceptual linkages with communication and coordination suggest a vague set of dependent variables for the states of relationships constructed by Laing and his associates.

Larson (1974a) proposes that within the family system of perceptual conjunctions there are analyzable subsystems of conjunctions. These subsystems are composed of the family member dyads such as father-son (FS), son-mother (SM), etc. Each of these dyadic subsystems represent the smallest relationship units but N-adic subsystems may exist in a family of N + 1 members. Larson focuses on the three levels of comparison following Laing, Phillipson and Lee.[1] However, Larson departs from the previous work in that he attempts to develop a solitary measure for interpersonal perception in a dyad or larger subsystem. In order to achieve this multiperception score, Larson scales the various combinations of agreement, knowledge,[2] empathy, and felt understanding. Each combination is ranked and weighted so that an aggregate score can be ascertained. However, this ranking procedure is somewhat arbitrary as Larson (1974b:23) notes in the following:

> [1]The ranking and weighting of each multi-perception factor is based on my best judgement through trial and error calculations. Differences are weighted, not similarities in order of importance: agreement <knowledge <empathy. Ultimately, these decisions should be made by a panel of judges.

There seems to be no clear-cut theoretical rationale for assuming that empathy should be ranked as more important than agreement. Larson (1974b:20) suggests that

> Level III perception permits a more intimate view of self-other relationships and the score of a kind of perceptual reciprocity where family members understand how others understand their understandings of them. It is argued that this level of perception is both the essence of empathy and communication.

This argument, however, seems an unsatisfactory rationale for ranking, since knowing Level III perception does not reduce the degree of freedom

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[1]Larson prefers the term "empathy" to that of "realization" used by Laing and his associates.

[2]Laing's "understanding."

associated with Levels I and II. Larson's work does point out the need for a more fully articulated theory of interpersonal perception. Furthermore, Larson initiates the application of interpersonal perception constructs to the study of the family and not just the marital dyad.

Larson criticizes the measurement technique (IPM) proposed by Laing, Phillipson and Lee. Larson (1974a:20) states that ". . . the mechanics developed by Laing, *et al.* (27) are excessively complicated: simpler procedures must be found." Alperson (1975) agrees with Larson. Alperson attempts to simplify the IPM by specifying the formal calculus which underlies the rather complex web of semantic formulations in the IPM. Since the IPM is basically a set of truth functional statements, Alperson formalizes these statements in Boolean algebra. The utility of Alperson's approach is that levels of perception and comparisons of levels can be specified precisely and unambiguously; and, furthermore, the scoring of the IPM is simplified. The Boolean analysis of the IPM makes explicit the underlying logic of the measurement typology (IPM) so that it can be more successfully integrated into a theoretical statement.

In summary, then, the theoretical perspective on interpersonal perception proposed by Laing, Phillipson and Lee (1966) has received the attention of many theorists; however, it remains a measurement typology and not a theory. The major problem with this perspective is that it is not systematically linked to other concepts so that a set of dependent variables is identified for research. Scheff (1967) and Klein (1976) have suggested linkages with the concepts of communication and coordination but these linkages are vague and can only be considered suggestive. Larson (1974a) has pointed out some of the problems with the IPM, and Alperson (1975) has redressed some of these grievances by formalizing the IPM in Boolean algebra.

2.1b The second theoretical perspective on interpersonal perception is that of balance theory. Although the balance theory formulation has not received widespread use in the study of the family (White, 1978), nonetheless it is a cogent framework which can interpret much of the empirical research on agreement and perceived agreement between family members. The notion of balance is associated with the work of social psychologists. This work tends to be of two kinds; either "balance" refers to the individual's cognitive consistency or attitude congruency, or "balance" refers to the relations between perceptions of an object and how another perceives that object. Undoubtedly, there is some overlap between these two schools of balance theory; however, some versions are clearly not focused upon interpersonal perception (i.e., Festinger, 1957; Osgood and Tannenbaum, 1955). This review directs its attention to the versions of balance theory that analyze interpersonal perception.

Heider (1944, 1946, 1958) is usually credited with the first systematic formulation of balance theory. Heider's theory contains three elements and the relations between these elements. The elements are the focal person (P), the other person (O), and some object (X). The relations between these elements are of two kinds. They may be relations of sentiment or unit relations. A relation of sentiment might be feelings of love, liking, etc., which may be summarized as positive or negative sentiment (affect). The unit relations refer to relations such as owns, buys, sells, etc., which are usually associated with the manipulation of objects.

An individual, according to Heider, orients himself to the object and to the other person's perception of the object. For instance, P may relations (+ or -) between these three elements (P-O-X) are the variables in the individual's interpersonal perception. This may be diagramed as follows:

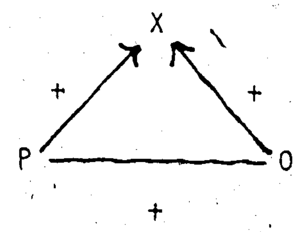


Figure 2.1. P-O-X Model

This figure illustrates what Heider calls a balanced cognitive structure. This is to say that there is no inconsistency for P when P likes X, P likes O, and P thinks O likes X. It must be remembered that these perceptions are in the cognitive structure of the focal person (P). Hence, to this extent Heider's theory is a cognitive theory of interpersonal perception.

Returning to Figure 1, it should be apparent that the substitution of one negative sign for any of the positive ones would mean a state of imbalance. For example, if P doesn't like X but likes O, and thinks O likes X, then the cognitive structure of P is imbalanced. In other words, P is faced with the inconsistency of liking someone who likes something he dislikes. When an imbalanced structure occurs there is a tendency for the individual to seek balance.

Imbalance produces discomfort or tension in the focal person so that there is a tendency for the individual to change one of the signs and, in this manner, achieve balance. For instance, where P likes O, dislikes X, and thinks O likes X, the change might be to change the sign of the P-O relation to a negative. This change results in balance since it is intuitively more consistent to dislike those that like what one dislikes.

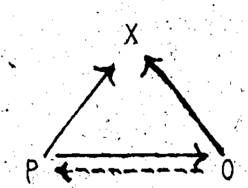
Heider assumes that the individual, once in a balanced state will stay there as long as not acted upon by exogenous variables. In other words, balance is similar to a homeostatic equilibrium. It is not balance but imbalance which predicts changes.

Although most of Heider's work was directly applied to the case where the focal person (P) perceives another's relation to X, it is possible to consider a larger number of others. However, the addition of N-adic relations quickly outstrips the ability of most scholars to intuitively assess balance or imbalance. This problem gave rise to the development of the formal analysis of balance. Cartwright and Harary (1956) formalized Heider's theory of balance using the mathematical model of signed digraphs. Their lead was subsequently followed by other scholars; Harary (1963), Flament (1963), Harary, Norman and Cartwright (1965), Morrisette and Jahnke (1967), and Taylor (1970).

The major contributions of the formal analysis of Heider's version of balance theory are the development of a formal definition of balance and the introduction of measures of the degree of balance in a structure. The definition of balance in formal terms facilitates the computation of balance or imbalance for complex structures. The measures of the degree of balance allows the comparison of structures where some are more balanced than others. Both of these developments advance the power and scope of Heider's theory. However, the formal analysis developed a technique which was applicable to the analysis of sociometric relations, as well as interpersonal perception. This unintended function of the formal analysis led to an increased emphasis on structural balance

Newcomb (1953, 1956, 1959, 1961, 1963) developed his version of balance theory with particular reference to interaction and communication. There are many similarities between Heider and Newcomb, and there are also some important differences.[3] One difference between Heider and Newcomb is that whereas Heider just assesses balance on the basis of the sign value (+ or -), Newcomb proposes a Likert-type scale from strong-positive to strong-negative relations. Therefore, Heider considers balance as being determined by the sign alone, but Newcomb considers not only the sign but the discrepancy between the weights of the relations.

Another important difference between these two formulations is that Newcomb adds a fourth relation to the three proposed by Heider. In addition to the relations of P's liking of X, P's liking of O and P's perception of O's liking of X, Newcomb introduces the relation of P's perception of O's liking of P. Diagrammatically, this may be expressed as follows:



(Taylor, 1970:25)

Figure 2.2. Newcomb's Individual Model

In this diagram the solid lines represent P's sentiments or unit relations and the broken lines represent P's perception of O's relations to X and P. The difference between Figure 1 and Figure 2 is that Newcomb adds the perception of the other's sentiment for P and, thus, distinguishes the directions of the two relations between P and O.

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[3]See Taylor (1970) for a comprehensive review.

The single most important difference between Newcomb and Heider is that Newcomb aggregates the individual system of orientation of P with the individual system of orientation of O. The aggregate is called the collective system. This collective system represents both perceived and actual relations in a dyad. In P's individual system of orientation (Figure 2), the focal person's perception of O's relation to X and O's relation to P may not be O's actual relation to X and P. Likewise, O's individual system of orientation may not accurately represent P's relation to X and O. However, the collective system takes into account the subjective reality of P's and O's perceptions and the reality of the actual relations in both individual systems.

Newcomb's formulation of balance theory has not enjoyed the same currency among formalists that Heider's has. Although Cartwright and Harary (1956:285) note that signed digraphs apply to Newcomb's version of balance, they neglect the scale proposed by Newcomb and the discrepancy measure. The issue of the formalization of the collective system is completely ignored in the formalistic analyses.[4] In a very real sense, Newcomb's work has not as yet directly benefited from formal analysis.

In summary, the balance theory perspective of both Heider and Newcomb conceptualizes interpersonal perception in the individual's cognitive structure. Newcomb differs from Heider in that, rather than three relations in the individual cognitive structure, he proposes a fourth, i.e., P's perception of O's relation to P. Both Newcomb and Heider conceive of balance ("symmetry" for Newcomb) as an equilibrium point in the individual cognitive structure. This notion of balance has

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[4]Taylor (1970) diagrams the collective sytem but does not apply formal analysis to it.

received formalization in the mathematical theory of signed digraphs. Heider and Newcomb differ on a crucial point. Whereas Heider conceptualizes individual perception as taking place only on the individual level, Newcomb attempts to aggregate the two individuals' systems of orientation into a collective system. The collective system represents the perceived and actual relations in a dyadic relationship.

2.1c The major similarity between interpersonal perception as formulated by Laing, Phillipson and Lee, and that proposed by balance theory, is that of levels of perception. Laing and his associates deal directly with levels of perception. Balance theory parallels the distinctions made by Laing, Phillipson and Lee to a considerable extent. For instance, the balance formulation of P's perception (or relation) to X is the same as direct perception for Laing, Phillipson and Lee. Furthermore, P's perception of O's relation to X is the same as Laing's "understanding." It is only on the third level, "realization," that balance theory fails to correspond. There seems no consideration of Level III or higher order perceptions in balance theory. Thus, the Laing, Phillipson and Lee, and balance theory formulations, share two levels of perception but not the third level.

The balance approach differs from the Laing, Phillipson and Lee approach in that it considers the affective relation between P and O as well as perceptions of X. Although the IPM operationalizes X as affective relations between husband and wife (P and O), it fails to conceptualize affect as other than an object statement eliciting a truth value from the subject. The balance formulation, on the other hand, conceptualizes the notion of affect or sentiment as a relation between P and O. The affect between P and O is not an object statement, X.

Rather, this affectual relation is measured independently from the assessment of P's relation to X and O's relation to X. Thus, the major difference between Laing, Phillipson and Lee and balance theory in respect to affect is that Laing treats affect as an object statement (X) with a truth value, whereas balance approaches affect as a separate set of measurements from those of the object relations.

Another difference between the two theoretical approaches is the degree to which salient issues are identified. Obviously, objects and issues (X's) vary in their importance to members of a dyad, depending on the type of relationship and the context of the relationship. The IPM identifies 60 issues which are most salient for he-she dyads. Balance theory does not identify which issues might be important for dyads in specific context. The failure of balance theory to specify salient issues is partially due to the fact that it is not coupled to a measurement technique such as the IPM. Rather, researchers in balance theory are left to their own devices to assess the salience of issues they address.

The most outstanding difference between the theoretical perspectives of balance theory and Laing, Phillipson and Lee, is that balance theory offers some predictive power, whereas Laing and his associates do not. Balance theory, at minimum, predicts change in relations or no change from the balance or imbalance of the structure. Laing, Phillipson and Lee do not offer any predictive power. This seems largely the result of their failure to link interpersonal perception with other concepts. This relegates Laing and his associates' work to the status of a measurement typology rather than a theory, if theory necessarily must have predictive power. However, Laing and his associates certainly offer a theoretical perspective if not a theory.

In summary, then, the major similarity of these two theoretical perspectives is that both consider two levels of interpersonal perception, i.e., direct perception and perception of the other's perception of X. The differences between the balance and Laing, Phillipson and Lee's formulations are numerous. Laing, Phillipson and Lee deal with Level III perceptions and suggest higher levels, whereas balance theory does not. Balance theory considers affect but Laing and his associates deal only with affect in the bounds of object statements (X's). The IPM identifies salient issues in the dyad, and balance theory leaves the assessment to the researchers. And, finally, balance theory offers some predictive statements, whereas the Laing, Phillipson and Lee formulation does not.

2.2 Empirical Research

Empirical research in the area of interpersonal perception in families is, for the most part, not connected with either the balance theory or Laing, Phillipson and Lee approach. The research in this area is typically an ad hoc approach using interpersonal agreement or interpersonal perceived agreement as measures. Although this research is not tied to either theory, the research is relevant to both theoretical formulations, since agreement is the comparison of two persons' direct perspective, and perceived agreement is one person's perception of the other's relation to an object or issue, i.e., Level II perception. Thus, the empirical research can be ordered as to its relevance for direct perception (Level I), perception of the other's direct perception (Level II), and perception of the other's Level II perception (Level III).

There is a considerable amount of research on agreement between family members. This research runs the gamut from studies of homogamy in dating to studies of marital disagreement (Blood and Wolfe, 1960). Agreement between two family members' direct perceptions has been used to predict role-taking ability (Davis and Rigaux, 1974) as well as marital adjustment (Christensen, 1976). Lewis (1972, 1973) cited similarity of perception as being one of the six crucial variables for the continuance or dissolution of dating couples. Bean and Kerckhoff (1971) found that subjects who perceived themselves or their spouses as responding differently from the opposite sex exhibited more conflict behavior. Although such studies on agreement may suggest correlations between disagreement and marital breakdown or any of a number of other possible correlates, it is difficult to ignore Larson's (1974b:10) indictment that ". . . *it would seem likely that the fact of disagreement is essentially useless information without ascertaining whether this fact is known by one or more family members* [emphasis in original]." Hence, Larson moves the discussion to what appears to be the more meaningful level where both agreement and perception of agreement are considered.

The preponderance of research on interpersonal perception in families lies in the area of Level II perception. Level II perception is perception of the other's direct perception. Kirkpatrick and Hobart (1954) investigate disagreement and perceived disagreement in dating couples and report only slight changes in disagreement from dating to engagement. Contrary to Hobart and Kirkpatrick, Dymond (1954:170-171) found that marital happiness is directly related to ". . . the partners' understanding of one another, as reflected in their ability to predict each other's responses to a series of items on a personality inventory." Dymond (1954:170-171) concludes that ". . . married love is not blind, and ignorance is not connubial bliss. The better each partner satisfactory the relationship." Luckey (1960a) concurs with Dymond. According to Dymond, those who score highest on marital satisfaction exhibit significantly greater agreement of perception in regard to self and the perception of self by spouse. However, Luckey (1960b) reports only a partial confirmation of the previous conclusions (1960a). A more complete confirmation is found in Luckey (1961 and Luckey (1964). Heer (1962) suggests that husband's perceptions of disagreements may be more accurate than wives'. Kogan and Jackson (1964) studied wives' perception of self and spouse. They report that positive self-perception is related to perceived similarity with husband. Ferreira (1964) reports that interpersonal perception is related to the acceptance or rejection of family members. Coombs (1966) found that when an individual perceives his or her date as valuing him, communication (self-reported) is enhanced.

[illegible]he vast amount of research subsequent to the Kirkpatrick and [illegible] (1954) findings support the proposition that marital satisfaction [illegible]ppiness is related to the accuracy of the partner's perception of [illegible] spouse's view on an issue. However, Udry (1967) finds that accuracy [illegible] mate perception is not a significant factor in predicting which of [illegible]0 engaged couples broke up over a five-year period. Goodman and Ofshe [illegible]968) speculate that empathy is related to communication efficiency in marriage. Although their results are ambiguous, their argument seems supported by the Scheff (1967) and Klein (1976) proposals. Hawkins and Johnson (1969) suggest that perceived role discrepancy is the precursor of marital dissatisfaction. Their results support the proposition that interpersonal perception at Level II is related to marital satisfaction.

game, find that both personality characteristics and person perception are operative in the husband and wife's attribution of conflict. Murstein (1972) reports that courtship progress among dating couples is predicted by the accurate prediction of partner's self- and ideal self-concepts, Schulman (1974) finds a high relationship between disagreements and errors in predicting the other's response among engaged couples. Schulman suggests that areas of potential conflict are skirted in communication and thus cannot be resolved or recognized. Larson (1975) investigates Level I and II perceptions among family members on the issue of marital roles. He reports that disagreement (Level I) varies from 54% in the married couple to 88% among brothers and sisters. Lack of knowledge (Level II) varies from 50% to 94%. The conclusion Larson reaches is that family differences in perception are more marked than similarities.

The research of Level II interpersonal perception tends to support the proposition that accurate interpersonal perception is associated with marital satisfaction. The findings of Larson suggest that many families might not attain very high levels of accuracy in their interpersonal perceptions. The fact that inaccuracy of interpersonal perception seems to be associated with blocked communications and conflict might, then, imply that those families that have low accuracy of interpersonal perception are in some pattern of conflict and have inefficient or blocked communications.

Level III interpersonal perception is the perception of the other's perception of one's perception of X. In other words, it is the perception of the other's second-level perception. This is the equivalent of the husband realizing that his wife understands that they agree. Due the rather cumbersome semantic formulation of Level III perception, only a few scholars have investigated this level. What investigations have been undertaken tend to be theoretical in nature. For instance, Laing, Phillipson and Lee (1966) investigated all three levels of perception using a small sample of disturbed and nondisturbed marriages. They found that at all three levels the disturbed couples demonstrate greater disjunction in the comparison of their perceptions. Larson (1974a) has discussed the theoretical importance of Level III perception. The dearth of empirical work in this area may be partially due to the obscure semantics of the Level III formulation and might reflect the feeling of scholars that this third level of measurement is largely redundant. However, there is little discussion one way or another.

In summary, then, there seems to be a strong empirical case for the importance of Level I and II interpersonal perception in families or dyads. The import of these two levels centers on the correlates of marital satisfaction, communication and conflict. Not only are these correlates suggested by the seminal work by Laing, Phillipson and Lee, using disturbed and nondisturbed marriages, but by the theoretical proposals by Scheff (1967) and Klein (1976) regarding communication and coordination. Larson's (1974a, 1974b, 1975) work leads to the speculation that if, in fact, there is little agreement (Level I) or understanding (Level II) among family members, then there also may be inefficient communications and conflict in these families, since these seem to be correlates of inaccuracy of prediction (Level II) and disagreement (Level I). At the very least, the empirical research points out that communication and family conflict are conceptual areas with which a theory of interpersonal perception in families must articulate.

CHAPTER III

COMMUNICATION IN FAMILIES

Initially, investigations into family communication received much of their impetus from marriage and family therapists. Family communication has been variously conceived as relating to schizophrenia and marital breakdown. Although research in this area tends to be oriented toward particular problems, nonetheless, a broad theoretical framework has emerged. This theoretical framework borrows many of its assumptions and concepts from cybernetics and communications engineering. It is the purpose of this chapter to introduce the theoretical framework which has emerged in the study of family communications and review the empirical research in this area.

3.1 Theoretical Perspectives

The foundation of much of the theorizing about family communication is the seminal work by Bateson, Jackson, Haley and Weakland (1956). Their work on the "double-bind theory" of communication between family members introduced the formal distinction of logical types into the interpretation of messages. Although subsequent empirical research has failed to support the double-bind theory (e.g., Schuham, 1967; Mehrabian and Wiener, 1967), it has had considerable impact on theorizing about family communications. This impact is mainly in two directions. Bateson, *et al.* (1956) viewed the family as a system where one member's behavior is interpreted in light of the patterns of communication in the system. This, undoubtedly, became the major way of conceptualizing family communication, i.e., as a system. A second impact of the work by Bateson, *et al.*, is the assumption that formal models may offer insights into the communication process. Bateson and his associates used the theory of logical types to explicate inconsistent communications. This direction was followed by numerous scholars who introduced such formal techniques as the theory of groups of permutations and Markov processes. These two directions, i.e., systems and formal models, characterize much of the work in family communications.

Jackson (1957) pursues the notion of the family as a system. Although he is directly concerned with family communication, it is assumed that the systems metaphor adequately describes family interaction in general. The idea of the family system as presented by Jackson is that each family sets up norms for the interaction of family members. These norms are evolved so that they become the goal state which family members seek. When the norms are achieved, then the family system is in a state of homeostasis or equilibrium. However, the divergence from these norms is reacted to by family members as though they are a homeostat. That is to say, that family members attempt to bring deviations back into line with the family norms. Jackson (1965) adds the suggestion that family communications might fruitfully be explored by the information theory approach associated with cybernetics (Wiener, 1948) and communications research (Shannon and Weaver, 1949).

Watzlawick, Beavin and Jackson (1967) follow the suggestion by Jackson (1965) that the information theory approach be applied to family communications. However, their contribution is much greater than the application of information theory to the study of the family. These authors introduce and apply the concepts of information theory in a unique and insightful manner. Previously, communications engineers had discussed the technical aspects of the communication channel.

Watzlawick and his associates (1967) introduced many of the same concepts but show how these concepts may illuminate human interpersonal communication. The concepts of function, information, feedback and redundancy are introduced and used to explicate human communication. Furthermore, these concepts are linked together into some tentative axioms regarding human communication.

The general view proposed by Watzlawick, Beavin and Jackson is that underlying human communication is a calculus or set of rules. When these rules are broken communication is disturbed. In such a situation communication about communication or metacommunication ensues to aid in the correction of the disturbance. According to these authors, one example of the disruption of communication is the "double-bind" situation. This situation is one in which the rule of communication that a class and its members are two distinct levels has, in fact, broken down. The breakdown of this rule can lead to disrupted communication and a pathological situation inside the family.

Besides applying information theory these authors, as well, view communication as a system. The systems perspective is accurate in that information theory represents only one form of system. Thus, the broader framework of their work is that of the systems approach. Several systems concepts are introduced such as wholeness, open and closed systems, and homeostasis. These concepts, in conjunction with those from information theory, are used to interpret the Edward Albee play *Who's Afraid of Virginia Woolfe?* Not only is this a lucid way in which to exhibit the concepts which have been introduced but it stands as a rather unique application of social theory to a literary work used as a proxy for real-life behavior.

Watzlawick, Beavin and Jackson have made a major contribution to the study of family communication and human communication in general. However, as with any pioneering effort, there remain many areas which have been introduced by Watzlawick and his associates, but need further scholarly attention and refinement. Since these authors introduced many concepts, their work is oftentimes general and speculative. It is the task of subsequent work to tie together the conceptual framework outlined by Watzlawick, Beavin and Jackson with the mathematical precision of information theory. Furthermore, many areas, such as encoding-decoding, digital and analog codes, need greater discussion and elaboration. It seems crucial that the measurement of the amount of information transmitted or received should receive greater specification. Without such attention the theoretical promise of the work of Watzlawick and his associates might never be fulfilled.

Lennard and Bernstein (1969) views family communication as a system which tends toward equilibrium. Thus, "The goal of adaptation in a social system could be formulated as the restoration of balanced interactional patterns" (Lennard and Bernstein, 1969:18). Lennard and Bernstein conceive of these "interactional patterns" in the family as being the social context of family members. The interactional patterns determine the behavior of family members. Proceeding from the work by Bales (1953), Lennard and Bernstein suggest that "normal" families exhibit more agreements than disagreements. They attempt to chart the level of agreements vs. disagreements (concordance ratio) for "normal" and "schizophrenic" families. Underlying the concordance ratio is the assumption that a certain level of agreements must be maintained in order to keep the family functioning smoothly, i.e., equilibrium.

Interestingly, the research results failed to support these assumptions. Families, both "normal" and "schizophrenic," show a lower proportion of disagreements than most groups investigated by Bales (1953). Furthermore, there is no significant difference (.05) between the two types of families, although there is a slight trend in the expected direction. Lennard and Bernstein speculate that the constraints on less stable groups to repress disagreements do not impinge on the family due to its stability and endurance. This seems to beg the question since stability for Lennard and Bernstein implies equilibrium, and equilibrium is the opposite of disagreement in their perspective.

Lennard and Bernstein (1969) also map the volume and channels of communication between family members. Especially interesting is the significant difference between the "normal" and "schizophrenic" families in regard to communications from the son to the father. In the "schizophrenic" families, the son-to-father communication is greatly reduced. Further differences are encountered in relation to the sons of "schizophrenic" families not interrupting as often as sons in normal families. The general picture Lennard and Bernstein draw is that the sons of "schizophrenic" families are more withdrawn and less assertive than those from "normal" families. However, any results are on shaky ground since the total sample includes only 18 families. Although this is a handicap in regard to generalizability, Lennard and Bernstein speculate about the theoretical importance of their work. Theoretically, they follow the communications systems perspective of previous work (i.e., especially Watzlawick, Beavin and Jackson, 1967). Lennard and Bernstein's major contribution is the initiation of mapping interactional sequences which have some theoretical implications. A major criticism of their work is that they fail to consider the nonverbal and analogic codes believed by Watzlawick, Beavin and Jackson to express affect. The reliance on verbal interaction as the sole indicator of communication certainly diminishes the theoretical relevance of their work.

Raush, *et al.* (1974) agree with previous authors that couples and families should be studied as systems. These interpersonal systems can best be studied as probabilistic systems where one person (S) responds to the behavior of another. This system can be modeled by a contingency matrix where the transition probabilities between states of the system are known. The conceptualization of system fits the earlier work of Raush (1972) where family interaction is viewed as a stochastic (Markov) process. Raush, *et al.* believe that families must adapt and manage conflict. The adaptation to conflict is a probabilistic adaptation, i.e., the type of conflict constrains the likelihood of certain behaviors.

In order to study conflict, and the way in which families adapt to it, Raush, *et al.* longitudinally studied 48 couples from the stages of "newlywed" to first pregnancy. Couples are given four interaction scenes which ensure conflict, and their responses are coded by observers. The Coding Scheme for Interpersonal Conflict developed by Raush and his associates relies solely on the content of verbal statements. There is no attempt to code nonverbal behavior. The results of their study suggest that a partner tends to react to the behavior of their spouse in a similar way; if one is attacking then the other tends to reciprocate, and if one is reconciling then the other tends in that direction. The exception to this tendency is rejection. If one spouse rejects the other, the response is most often either emotional appeals for fairness or coercive tactics. Obviously, if both partners reject one another, the relationship ends in conflict and dissolution. Another result of the study is that discordant couples engaged in longer sequences of interaction than other couples. In addition, wives from these couples tend to employ more coercive tactics than wives in other couples. The avoidance of direct communication about an issue is as likely in well-adjusted couples as it is for discordant couples. These "avoiders" were as happy in their marriages as those confronting issues.

Raush, *et al.* (1974) continue to use the theoretical stance of information theory and systems theory. Their major contribution is to suggest that interpersonal communication between a married couple may be modelled by a Markov chain. These authors pursued the purely verbal communication between husbands and wives with the techniques available at that time. It is interesting to note that Raush, *et al.* had the insight to foreshadow the contribution of Gottman (1977) which takes the same theoretical stance as Raush, *et al.*, yet adds the dimension of nonverbal behavior. Even though Raush and his associates appear to have some misgivings about the formal modelling of communication, they succeed in laying the foundation for subsequent formal models of interpersonal communication.

Kantor and Lehr's (1975) work stands as one of the most ambitious applications of systems theory to the study of the family. They attempted to show how families ". . . process information and develop strategies to regulate distances among members" (Kantor and Lehr, 1975:239). In order to achieve this goal, the authors develop a complex typology (Fig. 3, p. 150). The "test" for their theory is that it should explain the everyday, commonplace occurrences in the family. In other words, according to Kantor and Lehr (1975:xiii),

> . . . in order for a theory or model of family process to be viable, it should both emphasize and explain such commonplace events as the following: A small child stands outside his parents' bedroom door on Saturday morning. He knocks on the door. Both parents hear it. Mother says, 'Come in.' The boy enters and goes directly toward the bed where he hugs his still half asleep father, who groggily hugs him in return.

The explanatory model Kantor and Lehr propose divides family activity into the two classes of "access" and "targets." "Access" represents the physical quantitative dimension of family activity while the "target" dimension represents the qualitative goal oriented aspect of family experience (Kantor and Lehr, 1975:36). The access dimension is composed of the variables of time, space and energy. These three variables may take different values for each type of family. The target dimension has three variables--affect, power, and meaning--which may take different qualities as variables.

The family system is characterized as being either closed, open or random (Kantor and Lehr, 1975:116). Each of these types is identified by the values that type would have on the access variables and target variables. For example, the closed family system in regard to access variables has a fixed space, regular mechanical time and steady energy. From this discussion of family systems, the authors develop a typology of family systems on the access dimension and the target dimension.

The "interface" of these two typologies (i.e., the access dimension of the closed, open and random families, and the target dimension of the closed, open, and random families) yields a further typology of the closed, open and random family systems. According to this "interface" typology, the family systems can be characterized by their core purposes. The core purpose of the closed family system is viewed as "stability through tradition." The core purpose of the open family system is "adaptation through consensus," and the random family system's core purpose is "exploration through intuition" (Kantor and Lehr, 1975:150).

Kantor and Lehr introduce a normative element into their typology so that they may discuss family pathology. The following passage illustrates these normative biases:

> Unfortunately, not all families attain their ideals. Many approach them, but some fall far short, regardless of their typal propensity. As a result, when we look at families, we see many flawed, as well as ideal, versions of each type. For each theoretically pure or ideal variety of any of the three types, there is a corresponding theoretically impure or flawed variety. These flawed systems evolve out of a family's failure to consummate its typal design, either because it fails to attain its target ideals or because the criterion variables it evolves are inadequate for regulating access to those ideals (Kantor and Lehr, 1975:151).

Kantor and Lehr, in seeming contradiction to the above statement, assert that families in the real world are often mixed types but they do not indicate whether or not such mixture implies that real world families are all "sick" to the degree they are mixed or depart from the pure types.

The authors return to the example of the small boy knocking on the parents' bedroom door to illustrate the explanatory power of their theory. From the forgoing summary, it should be clear that their attempt at explanation is simply the labelling of various elements of the situation by their typological construct. Since the relations between elements of typology are not considered, Kantor and Lehr's "explanation" of this event is far afield from what most scientists would regard as explanation (i.e., deductive prediction). Furthermore, their application of systems analysis to the family seems only to introduce new jargon and types into their common language understanding. To refer to their work as a theory, whether systems or otherwise, seems premature if not audacious.

In summary, the theoretical perspective on family communication is characterized by the conceptualization of the family as a system. Much of the theoretical work utilizes the systems perspective in communications theory and communications engineering (i.e., Watzlawick, Beavin and Jackson, 1967; Lennard and Bernstein, 1970; Raush, *et al.*, 1974). Kantor and Lehr (1975) rely more heavily on the systems theory proposed by Buckley (1967). The major impetus for the conceptualization of the family as a system came from the work of Bateson, *et al.* (1956). Furthermore, this seminal work suggested the utility of formal models in studying family communications. The trend among theorists to focus on family pathologies such as schizophrenia can certainly be discerned. This focus seems to have resulted in theoretical statements which are more metaphorical than propositional. Hence, there appears to be much imprecision—in the statements offered by these theorists. This imprecision does not indicate that communications theory is vague but rather the manner in which it has been applied has been largely speculative and suggestive.

3.2 Empirical Research

The empirical study of communication in families is not marked by the same homogeneity as are the theoretical perspectives of family communication. Whereas it is possible to characterize the theoretical perspectives as sharing a systems viewpoint, such a succinct characterization is not possible in relation to the empirical research. As Aldous (1977) points out in her review, many different aspects of research on families overlap with the study of family communication. Therefore, research on such diverse topics as love, power and division of labor may overlap to various degrees with the study of family communication. For this reason the research on family communications tends to be scattered over and across several topic areas in family studies. This review brings these diverse studies together and points out interrelations when they are relevant.

An area that has received much attention from family researchers is that of communications and marital adjustment. Much of the impetus for work relating communications with marital adjustment came from Blood and Wolfe's (1960) study of Detroit married couples. They suggested that the quality of communication affected marital adjustment. Navran (1967) followed up this suggestion and found a high correlation (.82) between these two variables. Kahn (1969), using the Marital Communication Scale (MCS), operationalized nonverbal communication between spouses. His findings agreed with Navran's even though Navran dealt only with verbal responses. Kahn reports that happily married couples communicate more accurately than unhappily married couples. Bienvenu (1970) also found a high correlation (.93) between low scores on the Marital Communication Inventory (MCI) and couples in marriage counselling. Murphy and Mendelson (1973) measured marital adjustment using the Locke Marital Adjustment Scale. Their study concurred with previous studies in its findings; there is a high correlation (.84) between marital adjustment and the MCI.

Although the evidence seems to suggest a definite positive relation between marital adjustment and communication, there are some problems with this interpretation. Raush, *et al.* (1974) report that couples that avoid communicating on some issue appear as well-adjusted as other couples. Furthermore, since most studies in this area rely on questionnaire measurement, there is some doubt as to the semantic independence of the measures of marital adjustment and communication.

The study by Kahn (1969), however, reports a high correlation between nonverbal communication and reported marital happiness. The independence of the [illegible]asures increases the confidence in Kahn's findings. In gener[illegible]ms plausible that a direct relationship does exist between marita[illegible]nt and communication, but the research is, at present, [illegible]t con[illegible]. What appears to be needed is an explanation of how [illegible]mmuni[illegible]on leads to better marital adjustment (or vice versa).

[illegible]other area in family studies where research deals with family co[illegible]ation is marital intervention and therapy. Patterson and his as[illegible]ates (1971, 1975) conceptualize their intervention techniques in the [illegible]inforcement or behavioristic tradition. However, their suggestions for [illegible]rital intervention, such as getting couples to communicate in "non-avers[illegible]e" ways, and teaching couples "negotiating skills" such as contracts, exhibits these authors' relevance to communication in families. Another approach is that taken by Miller, Corrales and Wackman (1975) and Nunnall[illegible] Miller and Wackman (1975). These authors emphasize techniques of be[illegible] communication in marriage therapy. They view the communication process as directly related to the success and happiness of the marriage. Similar assumptions have been made by Boyd, *et al.* (1974). The problem with "research" in this area is that often the assumption that communication is the key to marital adjustment does not receive the critical treatment it deserves. The bulk of this research, then, only attests to the perceived importance of communication by marriage interventionists and therapists.

An area which is closely related to marital intervention is that of communications in disturbed families. Most of this research deals with families in which a child is diagnosed as schizophrenic. The research in this area has been closely tied to theoretical developments, specifically the work of Bateson, *et al.* (1956); Jackson (1957, 1965); and Watzlawick, Beavin and Jackson (1967). The acceptance and contribution of clinicians to family communication is acknowledged by various scholars (Franco, 1972). Some of the theoretical work in this area also reports empirical research as in the previously reviewed work of Lennard and Bernstein (1970) and Raush, *et al.* (1974). Larson (1967) reports the communication effectiveness appears more strongly related to dominance-submission than other factors such as prestige or credibility. The problem with Larson's work is that communication effectiveness is operationalized as three components which are not independent of the factors with which it is correlated. For instance, the evaluation component of communication efficiency overlaps with the factor of interpersonal attraction. One of the most outstanding contributions is the attempt by Mishler and Waxler (1968) to observe the interaction pattern between members of schizophrenic families (i.e., where one member is diagnosed as schizophrenic) and "normal" families. These authors operationalize interaction as verbal content. They report patterns of interaction for five "variable clusters"; expressiveness, strategies of attention, person control, speech disruption and responsiveness. Although they report differences between "normal" and schizophrenic families in each area, the most dominant research finding is that "normal" families are both more effectively expressive and expressive of positive affect than are schizophrenic families. A secondary, but interesting result of the Mishler and Waxler research is that, contrary to their assumption, "normal" families reveal higher rates of speech disruption and interruption than do schizophrenic families. In fact, the schizophrenic families in their sample were more characterized by their orderly interaction patterns and the quiescence of the schizophrenic child. The differences reported by Mishler and Waxler (1968) have led some to conclude that communication patterns cause the pathological individual. However, as Mishler and Waxler point out, it is equally plausible that families who have a schizophrenic child adjust their communication patterns to accommodate the needs of the pathological child. Hence, Mishler and Waxler offer a description of verbal interaction patterns between these two types of families, but no conclusion can be drawn as to the effect of communication patterns on the pathological individual or the effects of the pathological individual on their family's communication patterns. This problem is also cited by Jacob (1975) in his critical review of research on disturbed and normal families.

The area of communications in disturbed families is only marginally distinguishable from the research area of communications and family interaction. In fact, Aldous (1977) suggests that much research in family interactions is the same as family communications. Some research in family interaction, such as that by Lennard and Bernstein (1969), originates in the concern with disturbed families. Lennard and Bernstein (1969) attempt to study family interaction by observing the frequency and duration of interaction sequences between family members. These interaction sequences refer to verbal statements or communications to other family members. Bugental, *et al.* (1970) investigate differences between children and their parents in rating messages received verbally, by voice tone, and by facial expression. They suggest that young children may have some developmental differences in receiving messages since the facial expressions had less impact on them. One of the important issues raised by Bugental and his associates is that communication (or interaction) takes place on not just the verbal channel but the intonal and visual as well. Rosenblatt and Cunningham (1976) studied the relationship between tense interactions and families' television watching. They report TV watching is used as a means to reduce tense interactions and to some extent hold families together. It has been in the area of family interaction research that increased attention is given to nonverbal behavior. Although the nonverbal behavior being observed is as diverse as facial expressions and TV watching, it is still part of communication between family members. Coding systems and a sound theoretical base for such coding systems are still in their incipient stages.

One of the more outstanding recent contributions to the study of family communications confronts the issues of coding systems for nonverbal behavior and a theoretical base for such coding systems. Gottman, Markman and Notarius (1977) criticize previous coding systems for excluding nonverbal communication. In addition to the verbal content of a message, Gottman and his associates code the nonverbal behavior of the message sender (affect) and the nonverbal behavior of the message receiver (context). Findings indicate that nonverbal behavior is a more effective discriminator of distressed from nondistressed couples than is verbal behavior. Furthermore, the results suggest that there is only weak support for the hypothesis of positive reciprocity between nondistressed husbands and wives. The methodology used in testing the reciprocity hypothesis is ingenious and worthy of a brief digression. The reciprocity hypothesis basically states that a positive communication from one partner will elicit a positive communication from the other.

Thus, the probability of the second partner's communication is conditional upon the first partner's communication. Another way of saying this is that there is a reduction of uncertainty if the conditional probability is used instead of the unconditional probability of just the partner's communication. Gottman, Markman and Notarius (1977) feel that husband-wife communication is a chain of these conditional probabilities over a time span. In order to test the assumptions, expected values are generated by a sixth power Markov process (where the original matrix "M" is taken to M^6). The expected values, then, are compared with the observed values. The outcome of this methodology was to produce weak support for the reciprocity hypothesis. Perhaps a more valuable outcome is that this technique revealed markedly different systems of communication over time between the distressed and nondistressed couples. As Gottman, Markman and Notarius (1977:476) summarize

> The sequential analyses of both content and affect codes taken together thus provide summary descriptions of sufficient detail to suggest two different topographies for the two groups of couples. They do not simply differ in response frequencies, but they traverse essentially different terrains in their interaction.

The work of Gottman and his associates identifies with the theoretical position of Watzlawick and his associates (1967). The significance of the Gottman, Markman and Notarius (1977) contribution lies in their development of a methodology which follows the more precise version of communication theory. The problem is that neither Gottman, Markman and Notarius, nor other family theorists, have explicitly articulated this perspective. Certainly, Watzlawick, Beavin and Jackson (1967) have come the closest to a statement of communication theory; however, their work is introductory and needs further development.

In summary, then, communication in families can be viewed as an underdeveloped area. Most of the empirical research tests ad hoc hypotheses with little regard for their theoretical foundation. The most notable illustration of this is that only in the work of Kahn (1969); Bugental, *et al.* (1970); Rosenblatt and Cunningham (1976); and Gottman, Markman and Notarius (1977), has nonverbal communication been considered. This is despite the insistence of Watzlawick, Beavin and Jackson (1967) that the nonverbal channel of communication carries the bulk of affective messages; and it can be assumed that affective messages are of considerable importance in family communication. In fact, theoretical work such as those by Lennard and Bernstein (1969) and Raush, *et al.* (1974)--as well as major empirical research like that of Mishler and Waxler (1968) --fails to even conceptualize nonverbal communication let alone develop coding systems for nonverbal behavior.

Besides the area of nonverbal communication, there are other areas in need of development. The theoretical domain stands in need of some precise propositions rather than metaphor. The fact that most theorists in this area to date have suggested or borrowed from communications theory, indicates this as the direction for future developments. As well, the work by Gottman, Markman and Notarius illustrates the feasibility of a research methodology operationalizing concepts from communications theory. In general, the trend indicated by both the theoretical and empirical work in family communication is for a more precise theoretical statement about family communication based on communications theory.

Since much of the theoretical work in family communication has borrowed from communication theory or information theory, it seems advisable to take a more profound look at the original material.

Undoubtedly, family theorists, such as Raush, *et al.* (1974), and Watzlawick, Beavin and Jackson (1967), have found much of value in the original work of information theorists from the domains of mathematics and engineering. Hence, theoretical insight might again be furthered by a closer examination of these roots.

CHAPTER IV

COMMUNICATIONS THEORY

The theory of communications originated with the concern of mathematicians and engineers in describing and designing systems in telecommunications. Although, as Cherry (1957) points out in his review, there is a lengthy history of the contributions to communications theory, it is generally agreed that these contributions are congealed and elaborated in the work of Shannon and Weaver (1949). Shannon and Weaver's *The Mathematical Theory of Communication* (1949) presents the major conceptual distinctions in the field such as code, channel, information, etc., and elaborates the measurement and statistical treatment of variables in the communication system. Due to the generality of Shannon's discussion, his work is widely used and acknowledged in such diverse fields as telecommunications, biology and psychology.

Shannon, however, is by no means the sole contributor to the development of communications theory. Other contributions are from the areas of cybernetics (Wiener, 1948; Ashby, 1958) and information theory (Krippendorff, 1975; Singh, 1966). In fact, it is often difficult to clearly draw the boundaries of these three adjacent areas; communication, cybernetics and information theory. Furthermore, some authors view these three areas as being subsumed under the more general umbrella of general systems theory (Klir, 1969). The result is that applications of communications theory often draw upon a rather diverse set of concepts which appear under the rubric of communications theory. Hence, although some applications may draw directly from Shannon, others draw from Ashby (1958), Krippendorff (1975), MacKay (1956, 1961, 1964, 1967, 1969, 1972), and numerous other scholars working in the field.

There are two substantive applications of communications theory that pertain to the issues confronted in interpersonal perception and communication. Applications of communications theory in psychology have focused on the individual as an information processing unit. This is tantamount to considering perception and action in the individual. The second area of substantive application of communication theory is inter-personal communication. This application of communications theory relies heavily upon Shannon (1949) and conceptualizes two individuals as sender and receiver of a message. The purpose of this chapter is to examine these two applications of communications theory and the models of perception and interpersonal communication which have resulted.

4.1 Models of Perception

Applications of communications theory in psychology have resulted in models of perception. Most applications of communications theory in psychology have followed Garner and Hake (1951) in conceptualizing the individual as a communication system with input and output.[1] Garner and Hake turn the work of Shannon around by conceptualizing the individual as a channel through which the experimenter sends a stimulus and from which the experimenter receives a response. An important aspect of the Garner-Hake view is that information can be effectively measured as the contingent probability of the response. This statistical approach has dominated much of the concern with communication theory in psychology. As Dittman (1972:20-21) points out, much of the work in psychology has emphasized the measurement of information and its similarity to

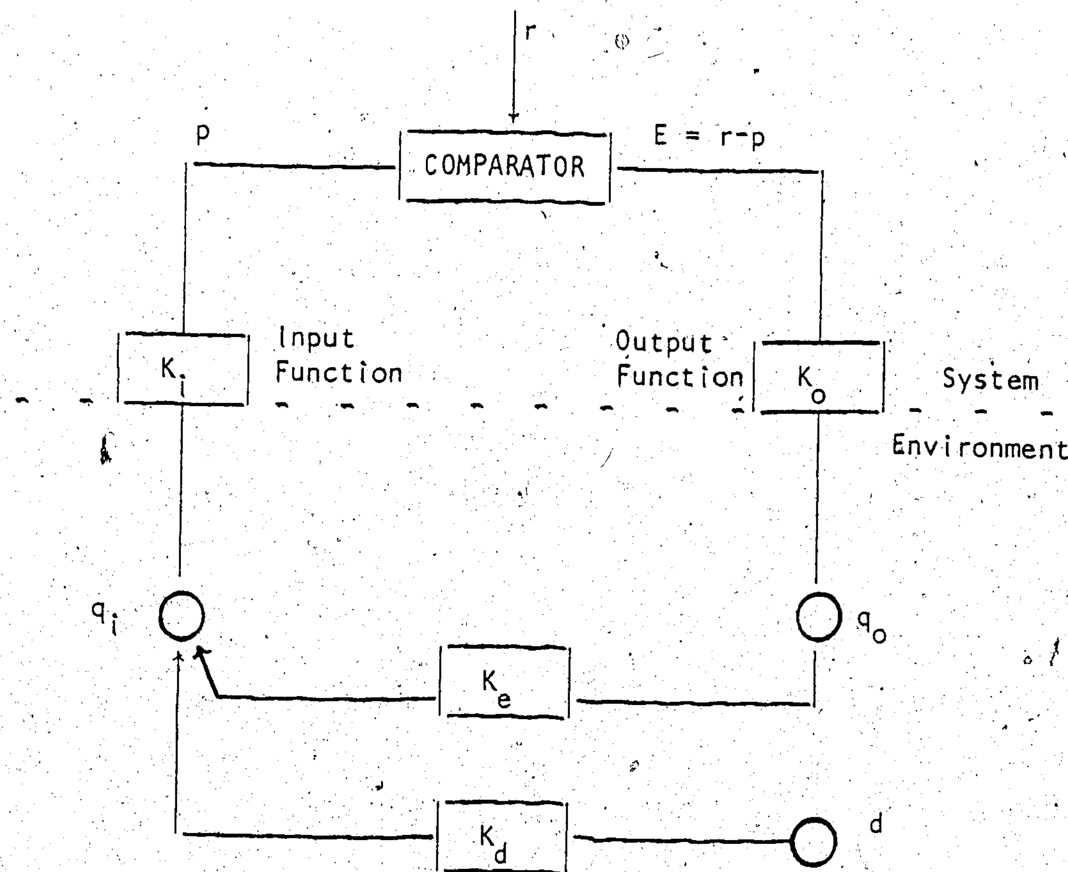
[1] A notable exception is the work by Mehrabian, 1972; Mehrabian and Wiener, 1967; and Miller, 1967.

statistical techniques such as analysis of variance (especially Attneave, 1959) while ignoring the conceptual analogy of the sender and receiver in interpersonal communication. Hence, the trend of this application in psychology is characterized by the focus on the information processing of the individual.

The information processing of the individual is discussed by Powers (1973) in a similar fashion to that pursued in psychology. However, Powers brings to the discussion the view of cybernetics. Basic to Powers' approach is the assumption that man's behavior can be interpreted as a control system. He conceives the human correspondent of a control device as having a reference signal that orients the organism in its behavior. The reference signal is of the same type as when the behavior of a thermostat is oriented to a specific temperature. With the human organism this reference signal is identified with the notion of purpose or goal. Powers (1973:50) states this as follows: "The purpose of any given behavior is to prevent controlled perceptions from changing away from the reference condition. Purpose implies goal: The goal of any behavior is defined as the reference condition of the controlled perception." In other words, the information processing (or perception) of the organism is directed so that the organism's behavior is an attempt to receive the incoming information which the organism seeks as its goal.

Powers' view of perception is somewhat difficult to grasp since usually the domain of perception is restricted to just the received sensations of the organism. Powers differs from this in that he proposes that perception be viewed as a system. This proposal is succinctly represented in the model Powers proposes.

Figure 4.1 illustrates Powers' view that behavior controls



where

r = reference signal

p = perceptual signal

q_i = quantity inpug

q_o = quantity output

Figure 4.1. Powers' Perception Model

perception. According to this model, the perceptual signal (P) is the result of the organism's behavior (q_o) as filtered through the environment (K_e) and the random disturbance in the environment ($K_d d$) transformed by the input function (K_i). In other words, the behavior that feeds back to the organism is composed of the organism's behavior in the environment ($K_e q_o$) plus the disturbance factor ($K_d d$). The organism is presented with behavioral input (q_i) which it perceives as filtered information ($K_i q_i$). This perceptual signal (P) is compared with a reference signal (r) so that the resulting signal is an error signal ($E = r - P$). The error signal is then transformed (K_o) into the appropriate behavior (q_o) designed to reduce the error in the system.

According to Powers (1973:274), this model yields four system-environment equations: "1. $p = K_i\, q_i$ 2. $E = r - P$ 3. $q_o = K_o E$ 4. $q_i = K_e\, q_o + K_d d$." From these four equations, Powers proceeds to investigate the effects of various constants on perception and to develop measurement units based on the maximum value of a perceptual signal. Furthermore, he considers the parameter of time delays in the system. He states that any control system may seem to oscillate wildly if the time delay is not considered as part of the sequential analysis.[2] The overall result of Powers' work is to supply a state model capable of sequential analysis of the organism's reduction of error through behavior.

Conceptually, this model proposes a technique with which to deal with goals in an operational way. This interpretation views an individual's goal (reference signal) as the empirical condition where the input quantity calls for no response or behavior from the organism. As Powers

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[2]For a detailed account refer to Powers (1973), Appendix, pp. 273-282.

(1973:65) puts it, "Since the error signal drives the system's output, zero error implies zero output effort. Thus, with this model, one can accept the concept of a goal without introducing either time travel or metaphysics." Furthermore, if a goal were defined in such a way as to be unreachable, then the individual ". . . would simply produce maximum output all of the time regardless of what the environment did, like a robot toy 'walking' with its face against the wall" (Powers, 1973:66).

MacKay (1972) presents a model very similar in design to that proposed by Powers (1973). MacKay, like Powers, focuses on the internal mechanisms of the individual in processing information. The model MacKay (1967, 1972) presents is a relatively simple homeostat. However, MacKay differs from Powers in that he introduces the metaorganizing subsystem which produces the reference signal. Until the system is capable of setting and evaluating its own goals, it is just a servomechanism or slave. MacKay (1967) suggests that the metaorganizing subsystem is a hierarchical arrangement of goals and that the comparator can reevaluate these priorities in light of new incoming information. For instance, MacKay (1967) uses the example of an eating man suddenly becoming aware of a threatening predator, and a change in behavioral priorities from the goal of satiation of hunger to flight or fight.

There is another rather important difference between MacKay and Powers. MacKay considers interpersonal communication as well as the subject of perception that both he and Powers share. MacKay regards communication to take place when a message selects (selective function) from the range of possible states of the receiver's system. Thus, in a communication system, information is measured by the change of state of the receiver; if there is no change in the receiver, then no information has been communicated. This view of communication is consistent with the definition as it has been commonly used in information theory. However, MacKay diverges from the mainstream in information theory by proposing that the operational correlate of "meaning" in a message is the selective function of the message. He distinguishes three types of meaning for a message; (1) the *intended* meaning of a message, (2) the meaning as *understood* by the receiver, and (3) the *conventionally* understood meaning. These three "meanings" may be operationally treated as (1) the selective function *intended* by the sender, (2) the *actual* selective function of the message for the receiver, and (3) the selective function for a *standard* receiver (MacKay, 1972:17-18). In order to ascertain the selective function intended by the sender of a message, MacKay must specify the sender's representation of the receiver's psychological states and, as well, identify which of these states the sender seeks to change. In regard to the selective function of the message for the receiver, the psychological states of the receiver would have to be identified and the change in state upon the reception of the message.

The problem with MacKay's (1972) suggestion to operationally treat "meaning" as the selective function of a message is that, at present, there is no way to specify either the representation of the receiver in the sender or the perceptual states of the receiver. MacKay's proposals in this area are thus speculative but not operational. However, MacKay can be credited with the insight as to the manner in which a control system model (as proposed by Powers, 1973) can be coupled via a communication system to another such control system.

Communications theory in psychology has centered upon the individual as an information processing system. The individual as an information processing system was originally discussed by Garner and Hake (1951). More recently, Powers (1973) applies a control systems model to the information processing of the individual. MacKay (1967) also proposes a similar control systems model. MacKay (1972) further suggests that two such control models be linked by a communications system. His proposal to operationalize "meaning" as the selective function of a message is not specified to the extent that it is feasible at this time. However, this proposal points the way in which models of individual information processing can be linked with a communications system. In other words, MacKay suggests the rudiments of a model of interpersonal communication.

4.2 Interpersonal Communication

Although the early work in communications focused on engineering and design problems in telecommunications, applications to interpersonal communication evolved into a field in its own right. Reviews such as Cherry's (1957) and the work by psychologists such as Miller (1963) aided this evolution. Speculative work such as that by Watzlawick, Beavin and Jackson (1967) is complemented by research efforts (Barnlund, 1968, Mehrabian and Wiener, 1967; Mehrabian, 1972; and Hind, 1972). Social psychologists employed the paradigm of communications systems in the study of social interaction (Parry, 1967; Argyle, 1969; Dittman, 1972). Though the study of interpersonal communications is not restricted to any one discipline, the evolution of this area of concern is at the stage where it may be considered a discipline in its own right as is indicated by the collection of Hanneman and McEwan (1975).

The study of interpersonal communications has not evolved away [illegible] original paradigm proposed by Shannon and Weaver (1949).

Rather, this paradigm has been conceptually interpreted for the study of interpersonal communications. For instance, concepts such as "channel" are interpreted as verbal and nonverbal behavior. The statistical theory of information transmission is still considered the formal model in the study of interpersonal communication (Rueben and Kim, 1975; Krippendorff, 1975). Hence, the present state of the theory of interpersonal communication can only be adequately depicted by a review of the extant concepts in the area accompanied by the corresponding statistical theory.

Basic to the discussion of communications theory is a conceptual diagram that has guided many authors in this area (i.e., Shannon, 1949; Singh, 1966; Krippendorff, 1975; Dittman, 1972). Although there is some variety in the elements which are considered, there exists a high degree of consensus on certain basic elements. These are included in the diagram in Figure 4.2 below.

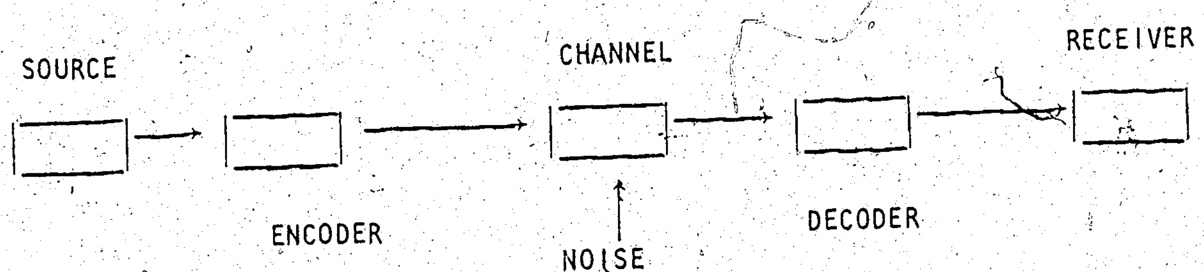

Figure 4.2. Conceptual Diagram of Communication

This diagram indicates the directed linear flow of a message. The first step in this process is that the source selects a message from a possible set of messages. For example, a telegrapher selects one message from a set of messages waiting to be transmitted. The next step is that the elements of this message, i.e., words, numbers, musical notes, etc., are transformed into a code such as Morse code. The code is then transmitted as a physical signal through some medium such as wire. This physical medium is called the channel. Every channel is subject to disturbance from the environment. As in the case with a telegraph wire, the disturbance could range from a broken line to electromagnetic interference. Such disturbances affect the clarity of the signal and these disturbances are called noise. The next step is that the signal must be transformed into its physical form, for instance electrical pulses in a telegraph wire, into the coded message, i.e., the dots and dashes of Morse code. This transformation is followed by the decoding of the code into an approximation of the original elements, words, numbers, etc. In other words, decoding is the reverse operation of encoding. The receiver gets an approximate message to that intended by the source or sender. The distortions to the signal due to noise, the errors in encoding and decoding, the sensitivity of the receiver, are all variables which make completely reliable transmission of a message an ideal only. In fact, much of the engineering work has been devoted to producing more reliable transmission by the addition of error-correcting codes, increased channel capacity and other technical innovations.

Each message sent in a communication system may be different in content and, yet, to devise any kind of theory there must be a common unit of analysis; i.e., a unit common to all messages regardless of content. An example serves well to illustrate how this unit has been devised as part of a metrical theory of information. Imagine that the source or sender of a message has been asked which of two roads leads to Rome. The source encodes and transmits his answer by the signal of pointing to the appropriate road. The receiver who properly decodes this signal will then realize that the northern road leads to Rome. In other words, the message serves to select one of the two possibilities. Thus, of the uncertainty the traveller had regarding the right road to Rome. If the traveller were blind then the message would not have been received and there would be no reduction of uncertainty. Since, in order for uncertainty to exist, there must be at minimum two possibilities, the basic unit of measuring uncertainty is the binary unit. This binary unit is known as a "bit." Thus, a bit is the smallest unit of uncertainty. It also represents the basic measure of information since information reduces the receiver's uncertainty. If a message fails to reduce the uncertainty of the receiver, then no information has been communicated, as in the case of the blind traveller who cannot see someone pointing to the correct road to Rome. This example illustrates that the amount of information communicated in a message is given by the uncertainty the receiver has before receiving the message minus the uncertainty after reception of the message.

In general, then, it is possible to view information as a selective function. In the case of the receiver, the selective function is to select from among a set of possible alternatives. This same selective function applies equally well to the sender's selection of a message. The sender of a message selects one message from a set of possible messages. The telegrapher selects one message to be transmitted from a basket of waiting messages. This choice can be seen as a reduction of uncertainty for the telegrapher. Uncertainty in this example is also measured by the number of possible "bits" that may be selected. The amount of information in the message as sent by the source is, thus, given by the number of possibilities from which a message is to be chosen. If there are N possibilities in the set, then this is an

An example serves to illustrate this selective function.[3] A telegrapher's key is capable of just two messages, a dot and a dash. Thus, there is only one bit of information in the system. The sender has only to select either a dot or a dash which is one binary decision. However, this example can serve to point out the need for a slightly different measure from the bit. Imagine that the telegrapher wants to send a compound message composed of three elements, each being a dot or a dash. The possible combined messages are illustrated in Table 4.1. Each key produces exactly one bit of information. However, the combined system is composed of three keys. Most authors feel that it is intuitively obvious that the united system be the sum of its individual components (Singh, 1966; Krippendorff, 1975). But, the sum is obviously not correct since 2 + 2 + 2 = 6, whereas the correct combination is 2 X 2 X 2 = 8. In other words, there are eight possible messages to be selected in this system. In order to maintain the intuitive additivity of this system, the sum of the keys should equal the product of the keys where the keys (events) are independent (A X B = A + B). The manner in which this is accomplished in information theory is to use logarithms. Logs have the property that their sum is equal to the product of the alternatives. For instance, in the combined system of the three telegraph keys the number of possible messages is 8. Since each key is binary (bit), the logs can be expressed to the base 2 so that $\log_2 8 = 3$. The inefective of $\log_2 8$ is 2^3 which equals eight. Thus, logs to the base 2 are usually used to express the number of possible messages from which the sender must

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[3]This example and discussion follows Singh, 1966:13-16.

tainty and reduction of uncertainty in the receiver. Hence, although the binary digit is the basic unit, the measurement of information is in logarithms to the base 2.

Table 4.1. Possible Combined Messages

Possible Messages	Key 1	Key 2	Key 3
1	Dash	Dash	Dash
2	Dot	Dash	Dash
3	Dash	Dot	Dash
4	Dot	Dot	Dash
5	Dash	Dash	Dot
6	Dot	Dash	Dot
7	Dash	Dot	Dot
8	Dot	Dot	Dot

Source: Singh, 1966:13.

Thus far only equiprobable alternatives have been considered. Suppose that in the binary system of the telegraph, dashes are more likely to occur than are dots. For instance, dashes may occur with a probability of 0.1. Accordingly, the information contributed by a dot is no longer the same as that contributed by a dash, but the dot contributes $\log_2 0.1$ and the dash $\log_2 0.9$. The information of the system must be weighted by the probability of selection of a dot or a dash. This yields the following formula:

$$0.9 \log_2 0.9 + 0.1 \log_2 0.1 = -.476 \text{ bits}.$$

This can be stated in general form as the Shannon formula for information: $H = - \Sigma\, pi \log_2 pi$[4]. This measure (H) attains its maximum value

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[4]Note that the minus sign is added so H becomes positive. Singh (1966:15) points out that this was done since logs of all proper fractions are negative numbers.

authors to interpret it as entropy (see Weaver, 1949; Singh, 1966).

The measure of information (H) makes possible the analysis of the communication system. For instance, the efficiency of a communication channel may be assessed by comparing the actual rate of communication flow with the total possible capacity of the channel. The capacity of a channel is estimated by the limit of the rate of information flow $\left(\frac{\log_2 N\ (T)}{T}\right)$ as the number of time intervals (T) are sufficiently large (i.e., approaching infinity).[5] The capacity of a channel can then be compared with the actual use to evaluate the efficiency. At present, the efficiency of a channel is of concern mainly to the telecommunications engineer. It has not been used in the study of interpersonal communication.

As Shannon (1949) points out, increasing the efficiency of a communications channel is mainly a matter of using the most efficient code. The code must be in a form that takes advantage of the capacity of the channel. A simple example is if Paul Revere had been forced to decode a series of binary signals for the 26 letters of the alphabet, so as to form the phrase "by land," his ride would have been delayed considerably. Not only would the transmission have taken more time but the possible errors in decoding would have been expanded. It is much more efficient to let the code be "oneth by land and twoeth by sea." Shannon proved that such optimal codes exist; however, his work does not specify the construction of a code for any concrete case. Rather, much attention has been devoted to constructing codes which are reliable and

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[5] For a complete discussion of the derivation of this formula, and the estimation of T, see Singh, 1966:22-28.

One method of increasing the reliability of a message, and insuring that the effects of noise and interference are minimized, is to repeat the message or the signal. For example, instead of hanging the one lantern up in the church tower for a minute, the lantern could be hung up all night. This would present a continuous signal so that if Paul Revere did not have his glasses on he would still be able to receive the signal after he donned his spectacles. Obviously, the repetition or "redundancy" of a signal increases its likelihood of accurate reception. However, greater redundancy of a signal on a specific channel restricts the amount of information that can be sent. If Paul Revere got the message on the first glance, then the lantern passes on no information on the second glance but is only redundant. This implies that redundancy and information carried on any one channel are inversely related. There must be some weight thrown by the sender of a message on clarity and redundancy or novelty and information, but to have both simultaneously is to have your cake and eat it too.

The notion of channels of communication is encountered in the study of interpersonal communication but in a less formal sense than found in Shannon's work. A channel is the physical medium which carries the message signal. If this physical medium is removed, then the signal cannot be transmitted. For example, a telegraph wire carries an electrical impulse, the signal. Air carries sound waves and light carries configurations. However, the study of interpersonal communication has for the most part left the study of these physical systems to the physical scientist. Instead, interpersonal communication has viewed the issue of channels from an aggregate perspective where there are either signals the importance of speech. However, as several authors have pointed out, there must have been a considerable span of man's evolution where the messages were predominantly sent on the nonverbal channels (Harrison and Crouch, 1975; Nolan, 1975). Hence, the research concern with verbal channels may be misleading since such a span of time must have been devoted to the development of nonverbal communications.

The distinction between verbal and nonverbal channels of communication goes beyond the idea of channel. Certainly a verbal output uses the auditory channel (sound); however, vocal expressions such as screams, grunts, and laughs are also transmitted via this same auditory channel and yet are clearly not verbal. The difference between a verbal utterance and a scream is the coding and not the channel. There appears a corresponding confusion in the notion of nonverbal channels. The vocal expressions, if not verbal, must be nonverbal. This distinction can only be maintained if coding is taken into account. Verbal utterances are not only auditory, they are coded so that each utterance has a corresponding meaning unit or morpheme. The difference between verbal and vocal utterances, then, is in the coding not the channel.

Categories of channels can be developed for interpersonal communication. However, these categories tend to be of rather limited use in the study of interpersonal communications. For instance, the two categories which undoubtedly carry the bulk of interpersonal messages are auditory channels and visual channels. More recently some investigators have been exploring the importance of tactile channels in interpersonal communication (Montagu, 1971). Such large categories, however, must be communication.

One way of more fully specifying the channel is to characterize the signal type it carries. There are basically two types of signals, those which are discrete and those which are continuous. A discrete signal is composed of discretely identifiable elements such as the presence or absence of an electrical pulse. Examples of discrete signal channels are the telegraph wire and signal and the page of a text which is a collection of discrete letters. Continuous signals, as eloquently described by Singh (1966:59), ". . . are often a continuum of sounds and colors, each merging insensibly with its neighbor, not unlike the speaking voice with its continuous variation of pitch and energy, or the imperceptible shadings of red into violet or orange-yellow in a Renoir rainbow." A continuous signal is, thus, a flow of magnitudes that mathematically can only be approximated, albeit with great fidelity, as discrete events.

The channels of interpersonal communication are all capable of carrying continuous signals. A touch varies in pressure, temperature, etc., continuously as does sound and sight. These continuous channels, however, may carry discrete signals as well; i.e., the lanterns to signal Paul Revere. The channel capacity for a continuous channel is much greater than for a digital channel since time intervals between a continuous signal are infinitely small. Thus, the channels of interpersonal communication have a much larger capacity than discrete channels. Interestingly enough, this implies that more information can be carried interpersonally when the continuous function of the channel is utilized rather than the discrete function.

termined by the nature of the transmitter. For instance, a person may encode a message in a continuous code; however, if they are biologically constrained so that they can only utter one sound or make one motion with no variation in amplitude, then they can only transmit a digital signal despite continuous encoding and the continuous capacity of the channel. The transmitter determines the signal as well as the code. Some of the transmitters used in interpersonal communication are the voice, face and body, and objects in the environment.

Encoding a message may take either of two forms. Digital codes are constructed from a basic finite set of elements. These elements have no resemblance to the things they may represent. For instance, the word "tree" does not look or sound like a tree. The meaning of a symbol in the code is arbitrary except where there is agreement that this symbol corresponds to a given meaning or thing. This arbitrary character of digital codes is illustrated by the many meanings of the symbol "+." When this symbol appears in the context of a road sign there is common agreement that it means crossroads. In the context of a mathematics text, the same symbol stands for the operation of addition. Language systems, spoken or written, are digital codes. There is no reason except convention why the letter "L" should correspond to the phoneme "L." The same goes for words. The word "blue" does not necessarily mean the color of the sky on a clear day but, rather, it is a convention that this is what it means. Children sometimes illustrate their understanding of the arbitrary nature of digital codes (language) by making whatever they say mean the opposite.

the symbol stands. A photograph of Jane looks like Jane. When one makes a motion like slitting one's throat to another person, the motion resembles the actual act. Even the analog computer bears a resemblance to that which it models. The degree to which an analog code resembles the thing it represents is called its degree of iconicity. When the degree of iconicity is high, then the code is easily decoded. Obviously, when iconicity is complete the relation between the code and the thing it represents is 1:1, as when an apple is used as a code for an apple.

Each type of code has limitations. Digital codes must be transmitted as discrete signals and, hence, are a less efficient use of a continuous channel. However, digital codes may be more precise than analog codes. Digital codes are not limited by the physical constraints of iconicity. For example, the idea of infinity can be digitally transmitted as "∞," but imagine the analog transmission with a high degree of iconicity, a ludicrous enumeration. On the other hand, analog codes convey large amounts of information, some of which may not be expressed in a digital code. For instance, a facial expression seems to contain more information than can be conveyed by a language description of the person's mood. Simply compare the information contained in a photograph of Bill with that contained in a description of Bill in a digital form.

The distinction between verbal and nonverbal communication takes on additional meaning in relation to analog and digital codes. Although verbal and nonverbal are not channels of communication in the proper sense, these terms appear to refer to a composite taxonomy of codes with channels. Verbal communication is, thus, the conjoining of a digital audition is digital. A whimper or scream is auditory but analogic. A semaphore transmission is digitally coded but not auditory. Table 4.2 represents these relations between channels and codes. This taxonomy illustrates that there is a large amount of communication which is digitally coded but transmitted on other channels besides the auditory.

Table 4.2. Typology of Codes and Channels

Channel	Code	
	Digital	Analog
Auditory	verbal	whimper siren scream
Tactile, Visual, etc.	stop sign clothing semaphore	gesture reflex body position

Furthermore, there is some communication which is analogically coded and transmitted on the auditory channel. Undoubtedly, the lines between these classes of communication are not as distinct as they appear. For instance, certain words may sound like the things they name, i.e., "slush" and "babbling brook." Although onomatopoeia is not that common, it still represents a grey area between the auditory-digital and the auditory-analog categories. Another grey area is between the visual-digital and visual-analog. Clothing may be digitally coded as is, for example, a mink coat with the idea of wealth. However, within the realm of clothing there also exists a range of expressions which seems as analogic as gesture and body position. Though these grey areas exist, as major inadequacy.

Such taxonomies shed light on the popular distinction between verbal and nonverbal behavior. However, in terms of theoretical concerns, the taxonomy may serve to conceal the distinction between codes and channels as the use of verbal and nonverbal categories has done. Hence, it would seem more precise to discuss the codes as either analog or digital and the channels as either carrying discrete or continuous signals. The inference from the type of signal to the type of code can be made without the conceptual blending into categories such as verbal and nonverbal.

The received signal must go through the same processing as involved in the transmission. The receiver must translate the signal into a code. A red, green or yellow traffic light is a visual signal which can be translated in the digital code of stop, go, and caution. The code is further transformed into semantic information which operates so as to select from a set of possibilities in the receiver; for example, stopping the car or crossing the crosswalk. If the receiver can only receive a narrow band of the signal being sent, for instance color blindness, then the message is distorted or lost. Even if the signal is received perfectly, the code into which it is translated may be different from the sender's. For example, a Hottentot Bushman might very well receive the signals from the traffic light and he may also have the semantic categories of stop, go and caution; however, the matching of the signal and semantic message via the decoding would be missing. Lastly, even though the signal reception and decoding are isomorphic with that of the sender, the receiver's set of possible messages may be different from

In summary, the theory of communications is applied in psychology to the area of perceptual discrimination. Following Garner and Hake (1951), models of the perceptual process as information processing developed. Two such recent models are those proposed by Powers (1973) and MacKay (1972). MacKay ties the information processing model of the individual to the communication system external to the individual.

The notion of interpersonal communication has received its most lucid formulations from interpretations of the model proposed by Shannon and Weaver (1949). The concepts of sender, selective function, encoder, transmitter, channel, channel capacity, information measure, noise, receiver, signal, decoder, and destination have all been briefly considered in this discussion. Some notable areas have been neglected, such as error-detecting codes, since they do not appear essential to a basic understanding of communication systems in interpersonal communications. The general model proposed by Shannon and Weaver (1949) has been discussed as it is applied by scholars in the area of interpersonal communications (e.g., Barnlund, 1968; Mehrabian, 1972; Hanneman, 1967). Although there is not complete consensus in all areas, consensus on the general concepts is high. The distinction of verbal and nonverbal channels used by several investigators (Mehrabian, 1972; Gottman, Markman and Notarious, 1977) is viewed as an imprecise mixture of codes with channels. It is proposed that more precision is gained by referring to codes and channels separately but still maintaining the inference from discrete and continuous signals to digital and analog codes, respectively.

Finally, the model proposed by MacKay (1972) can be viewed as perceptual with interpersonal communication [illegible]

perception and communication suggests the theoretical fusion of the work in interpersonal perception and communication in the area of the family.

A FORMAL MODEL OF INTERPERSONAL PERCEPTION AND COMMUNICATION

The previous chapters have reviewed interpersonal perception and communication in the family. Theoretically, the work on interpersonal perception is from either the perspective of Laing, Phillipson and Lee (1966) or the perspective of balance theory. The balance theory of Newcomb (1961) suggests dealing with individuals as well as communicating collective units such as dyads. The IPM (Laing, Phillipson and Lee) and balance theory have been formalized by Alperson (1975) and Cartwright and Harary (1956), respectively.[1] Although much of the work in family communications is not formal, the broader discipline of communications theory is much more so. Communication theory supplies both conceptual and analytic tools for the study of messages between a sender and a receiver.

From the interpersonal perception perspective, Newcomb (1961) envisions two individual systems of orientation coupled through interaction into a collective system of orientation. Hence, the way one individual views an issue, and the way the other views the same issue, are conjoined into a collective system representing the relationship. The conjunction or disjunction of the individual systems is viewed as dependent on communication.

The perspective of Newcomb is similar to that posited by MacKay (1972). MacKay regards interpersonal communication as two homeostatic

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[1]Also by Flament (1963); Taylor (1970); and others.

models linked by a communications system. The model of a homeostat is similar to balance theory in that both assume a goal state or balance to which the organism orients and corrects its behavior. Furthermore, MacKay, like Newcomb, suggests that these two individual systems are connected by a communication system. Information selects from the internal states of the individual system so that, as Powers (1973) points out, behavior or communication is an attempt to reduce the difference between the goal state and the selected state (or perception).

The suggestions by both MacKay and Newcomb point out that the theoretical development of either interpersonal perception or communications should proceed by the wedding of these two systems. This chapter seeks to develop a theoretical perspective on interpersonal perception and communication between two people. The approach used is to work on the most precise level available. Since formal models of interpersonal perception and communication are available, this seems to be the most appropriate and precise level at which to fuse the two perspectives. Hence, this chapter seeks to: (1) outline the formal treatments of balance theory and the IPM, and join them into a coherent model of interpersonal perception; and, (2) link two individual systems by a communication system composed of the concepts and measurements in communications theory.

5.1 Formal Models of Interpersonal Perception

This section presents the formalization of the IPM (Alperson, 1975) and that of balance theory. It is argued that these two models may be joined into a single and more parsimonious representation of interpersonal perception. The conjoint model of interpersonal perception maintains most of the relations in the Laing, Phillipson and Lee and balance formulations with the exception of using a binary rather than ternary numeral system.

Alperson (1975) translates the IPM into Boolean algebra. The measure of a statement in the IPM is its truth value. Although the IPM measures four truth values (++, +, -, --), these values simply represent subsets of the more familiar two-valued logic. In the IPM, both the husband and wife are asked to respond to a series of questions. These questions operationalize one person's perception of an issue (direct Level I perception), one's perception of the other's view of the issue (meta, Level II perception), and one's perception of the other's perception of one's view of the issue (meta-meta, Level III perception). The two respondents assess a truth value for each statement. Hence, there is a truth value for each person at each level of perception. According to Laing, Phillipson and Lee (1966), the measure of theoretical interest is the conjunction between the views of the husband and wife. In other words, interest centers on whether or not the truth values are the same for a comparison of the two perceptions.

Alperson's Boolean analysis treats this basic concern for comparison of the two perceptions as a matching between two variables. This is to say that when they match they share the same truth value. According to Alperson (1975:639), ". . . the basic I.P.M. relationship is obviously the equivalence function $A \equiv B$." The perceptions that are compared are listed as to the level and spouse. Hence, a husband's direct perception of an issue is notationally "H_1." The comparison of agreement between a husband and wife is thus the comparison of H_1 with W_1. Each perceptual level, H_1, H_2, H_3, may be valued true or false. The Boolean notation employed by Alperson is, for instance, $[H_1 \equiv T] \equiv h_1$ and $[H_1 \equiv F] = h_1$.

Using the more succinct Boolean notation, Alperson defines the various comparisons of the IPM as follows:

Table 5.1. Boolean IPM Comparisons (Laing)

agreement	$\equiv (h_1w_1 + h_1'w_1')$
understanding (husband's)	$\equiv (h_2w_1 + h_2'w_1')$
realization (husband's)	$\equiv (h_3w_2 + h_3'w_2')$

As well as the three levels of comparison favored by Laing, Phillipson and Lee, Alperson derives other first-order comparisons, i.e., comparisons between h_1, h_2, h_3 and w_1, w_2, w_3. These comparisons are as follows:

Table 5.2. Boolean IPM Comparisons (Alperson)

husband feels understood	$\equiv (h_1h_3 + h_1'h_3')$
husband expects wife to agree	$(h_1h_2 + h_1'h_2')$
husband thinks wife expects him to agree with her	$(h_2h_3 + h_2'h_3')$

Alperson also formalizes the second-order comparisons proposed by Laing, Phillipson and Lee. Second-order comparisons are comparisons between two first-order comparisons. As well as clearing up some ambiguity in the original Laing formulation, Alperson generates three additional second-order comparisons to the four cited by Laing, Phillipson and Lee. These seven determinations are given in Table 5.3.

Alperson's analysis clarifies the comparisons of the IPM and adds some additional second-order comparisons. The import of Alperson's work lies in the explicit formalization of the IPM. The truth functional

Table 5.3. Second-Order IPM Comparisons

husband feels understood correctly	$(h_1h_3w_2 + h_1'h_3'w_2')$
husband feels misunderstood correctly	$(h_1h_3w_2' + h_1'h_3'w_2)$
husband feels understood incorrectly	$(h_1h_3'w_2 + h_1'h_3w_2')$
husband feels misunderstood incorrectly	$(h_1h_3'w_2' + h_1'h_3w_2)$
husband's perception of being understood is veridical	$(h_1h_3w_2 + h_1'h_3w_2 + h_1h_3'w_2' + h_1'h_3'w_2')$
husband's perception of agreement is veridical	$(h_1h_2w_1 + h_1'h_2w_1 + h_1h_2'w_1' + h_1'h_2'w_1')$
husband's perception of wife's expectation of agreement is veridical	$(h_2h_3w_1w_2 + h_2h_3'w_1w_2' + h_2h_3'w_1'w_2 + h_2'h_3w_1w_2' + h_2'h_3w_1'w_2 + h_2h_3w_1'w_2' + h_2'h_3'w_1w_2 + h_2'h_3'w_1'w_2')$

Source: Laing, Phillipson and Lee (1975:648).

nature of the IPM is made explicit and, hence, becomes a factor with which balance theory must articulate. Rather, this is to say that the calculus underlying the IPM is a binary system of relationships.

Balance theory received a partial formalization in the seminal work by Heider (1946). Heider proposed two types of cognitive relations between people and objects, i.e., liking or L relations and unit or U relations. Heider diagrammed an individual's cognitive orientation to an object (X) and an other (O) as a triangle. He assigned a positive sign (+) to liking and unit relations when present and a negative to their opposite or absence. The assignment of signs by Heider presents an ambiguity. Heider does not make clear whether the negative sign of a unit or liking relation refers to the opposite relations as in "disliking" or the complementary relation as in "not liking." This formal distinction is important. For instance, if someone does not like another, it simply means that they either dislike or are neutral toward that person. This is the logical complement of liking. However, the interpretation of the negative sign as disliking means a partition of the logical complement into the neutral and disliking relations. If the negative sign refers only to dislike, then a third value is necessary to stand for neutral relations. This ambiguity is unresolved in Heider's work.

Newcomb's (1961) work appears to adopt the interpretation that a negative sign refers to the opposite rather than complementary relation. This suspicion is confirmed by Newcomb's treatment of weights of positive and negative relations. Although Newcomb does not specifically explore this issue, it seems that the assumption is that relations are a multi-valued linear system since the product of the weighted signs is used as a measure of balance, and the subtraction of weighted sign yields a discrepancy measure.

This ambiguity in the interpretation of signs is noted by Cartwright and Harary (1956) in their formal treatment of balance theory. Cartwright and Harary suggest that the mathematical theory of graphs illustrates the relations that Heider and Newcomb discuss. Thus, the Cartwright and Harary work stands as the first attempt to formalize balance theory with graph theory. They point out that ". . . Heider's terms, *entity*, *relation*, and *sign of a relation* may be coordinated to the graphic terms, *point*, *directed line*, and *sign of a line* [emphasis in original]" (Cartwright and Harary, 1956:283). Furthermore, the sign multiplication of the sides of Heider's triangular diagram yields an easily interpreted sign product, (+) or (-), balance or imbalance. This operation yields identical results with the more intuitive notions of balance such as "my enemy's enemy is my friend." The Cartwright and Harary formulation distinguishes three relationships; the presence of a relation (+), the opposite of a relation (-), and the absence of either a relation or its opposite (no line between points). Although this treatment avoids the ambiguity in the original Heider formulation, it also moves from the assumption of two values to three values by a partition of the presence of a relation into positive and negative. This three-valued function is distinct from the two-valued truth function used by Laing, Phillipson and Lee in the IPM and, hence, separates these two formulations in terms of isomorphism. However, a direct 1:1 isomorphism can be achieved by the reduction of the three-valued function to a two-valued function.[2] Another solution is to reconceptualize the IPM so that responses to an issue are three valued as in the balance and graph theory formulation. This alternative is not difficult to realize since the IPM already contains an implicit third response as no response. Thus, instead of the Alperson truth functional approach, the three-valued approach might be more realistic and a more accurate representation of the response values of the IPM. Furthermore, the three-valued approach would then be isomorphic with the graph theoretical representation of balance theory.

Besides the Cartwright and Harary (1956) approach, numerous other scholars have applied graph theory to balance theory (Harary, Norman and Cartwright, 1965; Morrissette and Jahnke, 1967; Flament, 1963; Taylor, 1970;[3] Beauchamp, 1970, 1977). All of these applications of graphs to balance theory, with the exception of Flament (1963), have considered the static states of balance and measures of the degree of balance in a graph. Without exception, these formulations reveal a high degree of

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[2]This idea was clarified in discussions with P [redacted]

[3]Taylor (1970) offers a good introduction to the graph theoretical interpretation of balance as it has been developed in psychology.

consistency in their interpretation, thus making possible a succinct review of the basic notions.

Balance theorists agree that there are certain basic concepts in balance theory. These basic concepts are elements, relation, sign, type of relation, and system.[4] The idea of balance from a psychological viewpoint is that cognitive elements are related by either a positive relation or negative relation or else there is no relation. In a cognitive structure, balance is interpreted as the consistency of relations. Thus, for a triangular structure, either two negative and one positive or three positive relations yield a balanced system. In terms of graph theory, these basic concepts of balance theory correspond to the concepts in graphs. These correspondences are as follows:

Table 5.4. Correspondence between Graph and Balance Theory

Balance Theory	Graph Theory
element	point
relation	line
type of relation	type of line (type 2 ... N)
sign of relation	sign of line
system	graph

According to Table 5.4, the basic or primitive concepts of balance theory have a one-to-one correspondence in graph theory. Thus this isomorphism should continue for derived notions such as the balance of a graph. The advantage of graph theory is that its deductions are more clear and precise, and it facilitates dealing with complex structures of N-relations.

[4]Taylor (1970:53) presents some of these in Table 1.

Cartwright and Harary (1956) introduce the application of graphs to balance theory. They define a graph as consisting of a finite set of points and a subset of unordered pairs of points. These unordered pairs of points represent the lines of the graph. For instance, the unordered pairs of points, AB, BC, and AC specify a graph connecting points A to B, B to C and A to C; hence, a triangle. A directed graph (digraph) is given by a subset of ordered pairs of points where one point is designated as the first point and the other as second. The resulting lines of the graph are directed so that $\overrightarrow{AB}$, $\overrightarrow{BC}$, $\overrightarrow{AC}$ represent a different set of relations from those in a graph of unordered pairs. In both graphs and digraphs, a relation may be either present or absent. However, in signed graphs (s-graphs), a present relation may take on a signed value of either positive (+) or negative (-). A signed digraph is, then, a signed subset of ordered pairs. Every graph may be analyzed as to its cycles. A cycle is composed of the paths which return to the point of origination. Hence, one cycle is composed of the lines AB, BC, CA. A semicycle is constructed of ordered pairs which return to the point of origin. For example, $\overrightarrow{AB}$, $\overrightarrow{BC}$, $\overrightarrow{CA}$ represents a semicycle whereas BA, CB, CA represents a cycle.

These definitions make possible the analysis of the correspondence between graphs and balance. The elements of balance, objects or persons, become points in graph theoretical terms. The relation between elements correspond to relations between points. And the sign of the relation corresponds to the sign of a directed line. According to Heider (1958), balance is defined by the sign multiplication of the adjacent sides of his triangular P-O-X diagrams. In graph theory, the sign of a cycle is computed by the sign multiplication of the signs of its lines. And, in the case of signed digraphs, the balance of a structure or graph is computed by the sign multiplication of the lines in the semicycles.[5] Although there are three different methods of counting cycles, two of these yield the same result and the Cartwright-Harary method is by far the most popular and most uncomplicated (Taylor, 1970:55-56).

The Cartwright-Harary method, as suggested by the definition of cycle, counts as a cycle any path such as AB, BC, CA. Consistent with this method of counting cycles and the definition of balance, is the proposition that a signed graph is balanced if all of its cycles are positive. Thus, for the following signed graph there is only one cycle and it is positive.

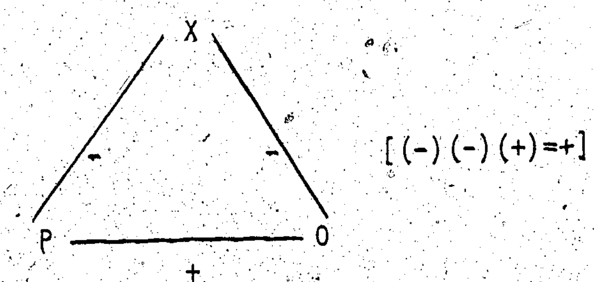

Figure 5.1. Positive Cycle Graph

For graphs where the number of relations is large, the counting of cycles quickly becomes cumbersome as a way to compute balance. Cartwright and Harary (1956:286) derive two theorems which aid the computation of balance in complex graphs. One theorem is stated as "an s-graph is balanced if and only if all paths joining the same pair of points have the same sign." For instance, the graph in Figure 5.2 is balanced since all the lines connecting any two points yield the same product. So, the product

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[5]For cases where the number of relations are <3, the cycle and semicycle are identical.

of all the paths connecting point Q with R is negative and Z with Q is positive.

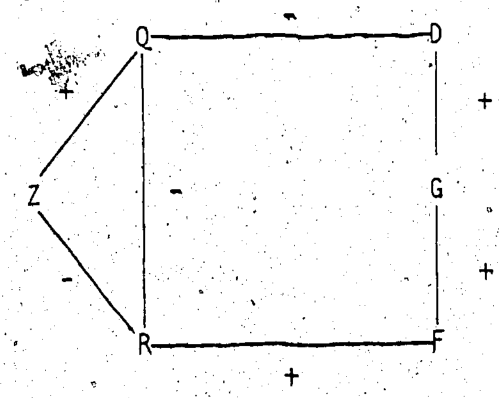

Figure 5.2. Complex Graph

The second theorem derived by Cartwright and Harary (1956) is called the "Structure Theorem." It states that "An s-graph is balanced if and only if its points can be separated into two mutually exclusive subsets such that each positive line joins two points of the same subset and each negative line joints points from different subsets" (Cartwright and Harary, 1956:286). In Figure 5.2 there exist two subsets which are disjoint in accord with the structure theorem. These are (Q, Z) and (R, F, G, D). Clearly, Figure 5.2 is balanced according to the structure theorem. The structure theorem has been used to discuss factions and parties (Beauchamp, 1977) as it is readily interpreted in this way.

One area that has received considerable attention in formal treatments of balance theory is the measurement of the degree of balance in a graph. The comparison of two graphs in terms of their being either balanced or unbalanced does not supply as much information as a researcher might desire. As Cartwright and Harary (1956:288) point out ". . . it is intuitively clear that some unbalanced s-graphs are 'more balanced' than others!" Thus, Cartwright and Harary suggest a measure for the degree of balance in a signed graph composed of the ratio of positive cycles to the total number of cycles in the graph. This is expressed symbolically as

$$b\ (g) = \frac{c + (G)}{c\ G}$$

where c (G) = the number of cycles of graph g
c + (G) = the number of positive cycles
and b (G) = the degree of balance on graph G (Cartwright and Harary, 1956:288).

This measure depends on the number of cycles in a graph. In graphs of only one cycle, the measure assumes its absolute values of one (balance) or zero (imbalance). Thus, the comparison of simple graphs with complex graphs is rather misleading using this measure since graphs with a small number of cycles have restricted values.

Other measures of the degree of balance have been developed; however, most suffer the same drawback as the simple ratio measure proposed by Cartwright and Harary (1956). For example, the notion of N-balance developed by Cartwright and Harary (1956), and Harary, Norman and Cartwright (1965) measures the degree of balance in an s-digraph. It is still a simple ratio but only considers the cycles up to and including N and ignores all cycles larger than N. Another measure is proposed by Morrissette (1958) to deal with graphs where the strength or weight of the sign is given. According to this formulation, the weighted product of all cycles is summed and divided by the absolute sum of all weighted cycles in the graph. This is, of course, a variation on the Cartwright and Harary ratio. However, by taking the sum of the weighted products, this measure makes the assumption of linear additivity of weights or strengths; an assumption that is certainly difficult to justify.

Flament (1963) develops a measure of the degree of unbalance in a graph. The Flament measure of the degree of unbalance is based on the earlier proposal by Abelson and Rosenberg (1958) that a measure be tied to the balancing process. This is to say that the degree of unbalance should reflect the number of sign changes necessary to reach a balanced graph. Flament suggests that the degree of unbalance be measured as the minimum balancing set of a graph. A balancing set is understood to mean the set of vertices or edges of a graph which the changing of the sign yields a balanced graph. The Flament measure only seems to avoid the pitfall inherent in the Cartwright-Harary ratio. The measure of unbalance reflects the total number of balancing sets for any graph. Flament (1963:99-101) shows that any graph has $2^{(N-1)}$ balancing sets. Hence, the minimum balancing set is a function of the number of vertices in the graph and the minimum balancing set is affected by the complexity (N) of the graph. The Flament measure, then, does not escape the problem of comparing graphs of small N with larger more complex graphs. However, the Flament measure does focus on the balancing process rather than the comparison of static states of graphs.

Flament's discussion of the balancing process not only exhibits the usefulness of his measure of unbalance but is instrumental as well in later discussions in this paper. Flament assumes that the whole notion of balance necessarily implies that there is a movement from imbalance to balance. He further hypothesizes that this movement occurs by changing only one sign at a time.[6] The movement to balance can be traced by a lattice proceeding from a totally negative graph to a

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[6]Although Flament does not explore the substantive implications of this hypothesis, Abelson and Rosenberg (1958) do suggest the "least cost" interpretation to be discussed later in this paper.

totally positive graph. However, the notion of balance defined by Heider where two negative signs and a positive sign is balanced is replaced by Flament's definition of all positive signs. Flament, however, does not interpret this in a substantive way. Flament's degree of unbalance can be interpreted as the shortest path through the lattice for a graph so that it is transformed to a positive graph. But the graph can change only one sign at a time so if there exist k graphs one sign more balanced than a graph, then the probability of moving to one of these graphs is 1/k. Flament suggests that such a movement from one state to a more balanced state is modeled by a Markov chain. Hence, the balancing process is interpreted as a stochastic process where over time the graph approaches the asymptote of balance.

Flament's suggestions regarding the balancing process have as yet received little attention from substantive theorists. Even Taylor (1970) in his review fails to mention the idea of a stochastic model of the balancing process even though there is a cursory mention of Flament's measure of unbalance. Perhaps the major drawback to Flament's proposals regarding the balancing process is that much of his work is not easily interpreted in substantive terms. The difference between Flament's idea of balance as totally positive signed graphs is in direct opposition to the Heiderian notion of balance as an odd number of positive signs. However, this is just one example where the formal and substantive theories do not articulate.

5.2 Interpersonal Perception

The formal models of interpersonal perception can be fused into one theoretical perspective. This section proposes a theoretical perspective which integrates the IPM with balance theory. Furthermore, some of the proposals by Flament are given substantive interpretation in light of the fused theoretical perspective on interpersonal perception.

The major contribution of Laing, Phillipson and Lee to the study of interpersonal perception is to shift the focus of the study of interpersonal perception from the individual to the relationship. Although the IPM taps individual responses, what is important for Laing, Phillipson and Lee is the comparisons of the individual responses to reveal the texture of the relationship. It is in this sense that the study of interpersonal perception becomes, at minimum, the study of the dyadic relationship.

Although there are a number of variations of balance theory, there is a unifying dimension which underlies the various formulations. The unifying dimension is the viewpoint that a unit of analysis, whether it be a group or cognitive elements, prefers a balanced state to imbalanced states. Most of the balance theorists would describe imbalance as psychologically uncomfortable and balance as harmonious and consistent. Balance is the goal state toward which an individual or group tends. In other words, if an individual or group is in an imbalanced state, then the prediction is that change will occur in the direction of balance. Most balance theorists view their subject as being like a homeostatic device. That is, when the system is in an unbalanced state, the subject will try to return to balance. Once a balanced state is attained, the subject will not seek imbalance but rather is subjected to imbalance by changes in variables in the external system or environment.

The many varieties of balance theory may be classified as being one or the other of two types. One type of balance theory concerns itself with cognitive processes in the individual. This type of balance theory includes the work by Festinger (1957) on cognitive dissonance, Osgood and Tannenbaum (1955) on attitude congruity, and Rosenberg and Abelson (1960) on attitude organization. The second type of balance theory focuses upon interpersonal relations and groups. Theorists like Heider (1958), Newcomb (1961), and Cartwright and Harary (1956) are included in this second type. The emphasis in the second type of balance theory tends to center on the balance in a dyad or any larger N-group of persons.

The splitting of balance theory into two types is, for the most part, a clearly justified partition. However, one theorist, Newcomb, tends to deny the disjoint nature of the two types. Rather, his work can be viewed as both cognitive and interpersonal. Newcomb proposes two "systems of orientation." One system is the "individual system" which describes the individual's attitudes (perception) and attraction (affect). The individual system is a model of the way an individual feels about and perceives another person. The model for person H would include his feeling about person W, his attitude toward X, and his perception of W's attitude toward X. These three relations can be diagrammed as follows:

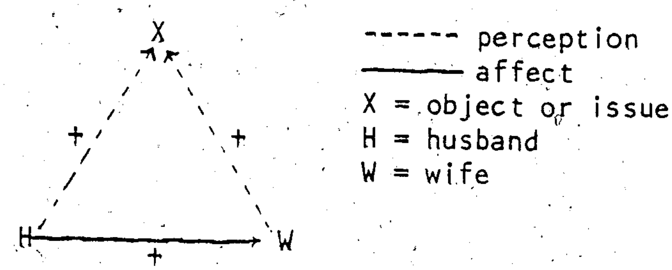


Figure 5.3. The Individual System

The familiar triangular diagram is the representation of individual H's perception and feeling in an interpersonal relationship. This is a representation of H's system of orientation and does not necessarily represent the actuality of the relationship. Rather, it represents the phenomenology of person H's orientation. And, likewise, there is a representation for person W. Each model may be balanced or imbalanced. Person H may be balanced and, hence, not desire a change while W may be imbalanced and, according to the balance principle, seek a balanced state.

To express the interaction of these two individual systems, Newcomb aggregates the individual systems into a "collective system." The "collective system" represents the two (or N) persons' individual systems of orientation when they interact. The importance of such an aggregation can be easily overlooked if the assumption held is that interacting individuals are explainable by the private perspective of each one. The "realist" view is that a new entity, the relationship, is not reducible to the two individual perspectives. It is the "realist" view that group relationships are qualitatively different from the isolated individual's system. The aggregation technique used by Newcomb (digraph theory) presents the possibility that two individual systems considered separately may be imbalanced but that as a collective system they are balanced. A familiar example of this type of situation is where the husband (H) doesn't like housework, loves his wife, and believes that she likes housework. This is an imbalanced state on the individual level since, according to balance theory, if H likes W then he wants W to agree with his attitude on X. However, the above situation may be complemented if the wife (W) likes housework, loves her husband, and believes that he doesn't like housework. Both individual systems in this example are imbalanced. However, the collective system is balanced. That is, the relationship is in harmony on this issue since the perspectives are complementary. In the following diagram this aggregation is expressed and can be understood mathematically if each side of the individual triangles is sign multiplied times the corresponding side of the other individual triangle.

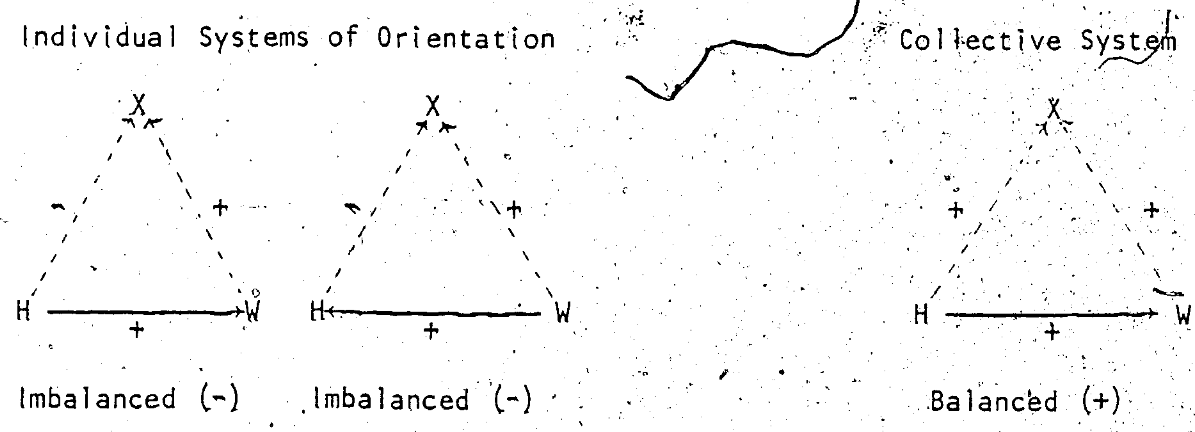


Figure 5.4. Individual and Collective Systems

Although both balance theory and the IPM formulation have some similarities they are not isomorphic. These two formulations are complementary and treat different dimensions of the interpersonal phenomenon. An example will help highlight the manner in which these two are linked. Imagine a situation in which the husband (H) doesn't like to discipline the children but thinks his wife (W) does like to discipline them. In addition, we can imagine that the husband and wife love each other; in other words, the affect is positive. Further imagine the wife's perspective to be that she doesn't like to discipline the children but perceives that the husband does like to. The individual systems of orientation of the husband and wife are diagrammed below. Following the sign rule of multiplication, it can be seen that both the husband's and wife's system of orientation is imbalanced, i.e., inconsistent. However, following Laing, Phillipson and Lee, the husband and wife agree; neither

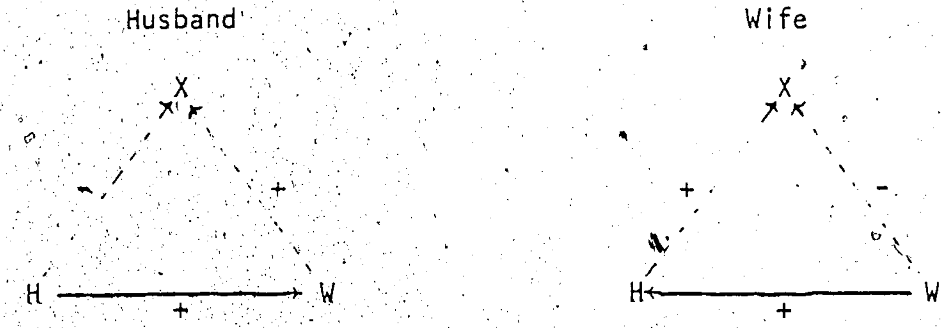


Figure 5.5. Individual Systems of Orientation

likes corporal punishment, but they fail to understand that they agree. Each partner believes the other to like what they do not like. The representation of the collective system shows that the relationship is balanced. The balance of the collective system points out that, even though the individual systems are in disequilibrium, the relationship is balanced. If the husband doesn't like to discipline, and the wife doesn't like to discipline, and the mutual affect is positive, it is a balanced relationship. This relationship of balance exists even though neither of the individuals understands that they agree. Undoubtedly, there is a need to interpret the meaning of balance when there is no understanding. This point needs to be more fully treated in a theoretical framework.

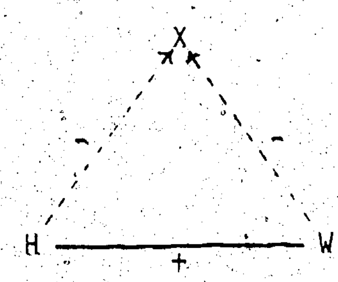


Figure 5.6. Balanced Collective System

There is another area where the IPM and balance theory do not articulate. This is the area of "realization." Agreement and understanding can both be viewed in the diagrams above; however, realization cannot. Realization is the perception by one of the other's understanding. In terms of the diagram forms used previously, it would be represented as follows:

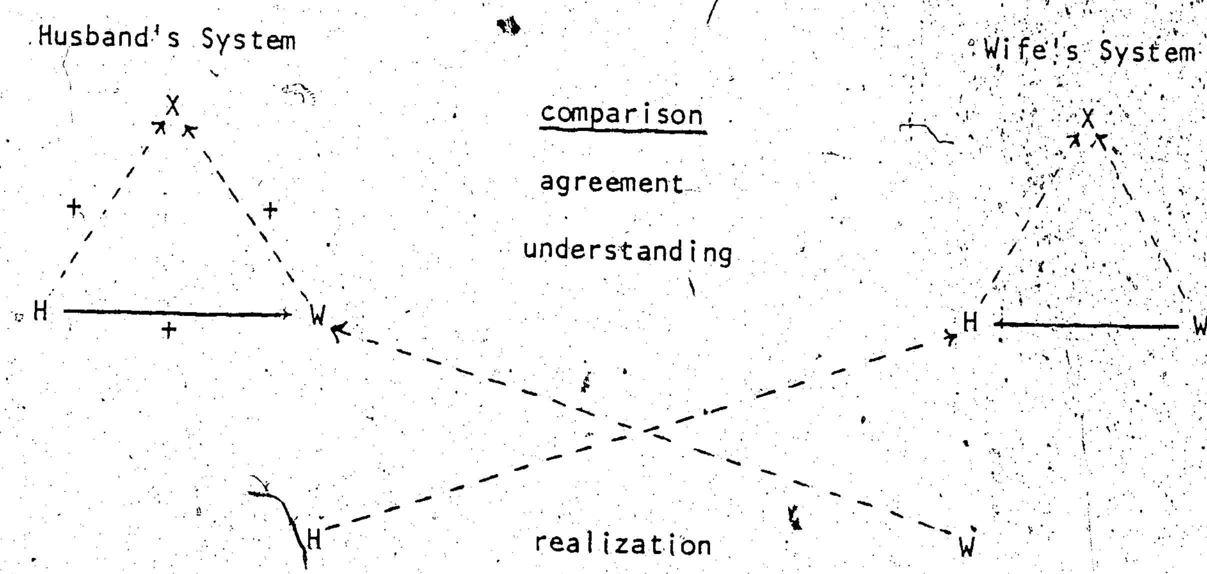


Figure 5.7. Realization Comparison

According to this diagram, realization is outside of the individual systems of orientation. Why is this? This apparent discrepancy points out an important theoretical and methodological distinction.

There is a difference between the researcher's comparison of interpersonal agreement and understanding, and the comparison of agreement and understanding by either the husband or wife. Examine the comparisons between interpersonal perception of the two individual systems as performed by the researcher (Figure 5.8).

The researcher can ascertain, via the measurements of the IPM, the agreement and understanding in the two individual systems. The notion of realization, however, supposes that either the husband or wife are performing these comparisons. This means that realization is the husband's or wife's perception of understanding. It is also possible that the

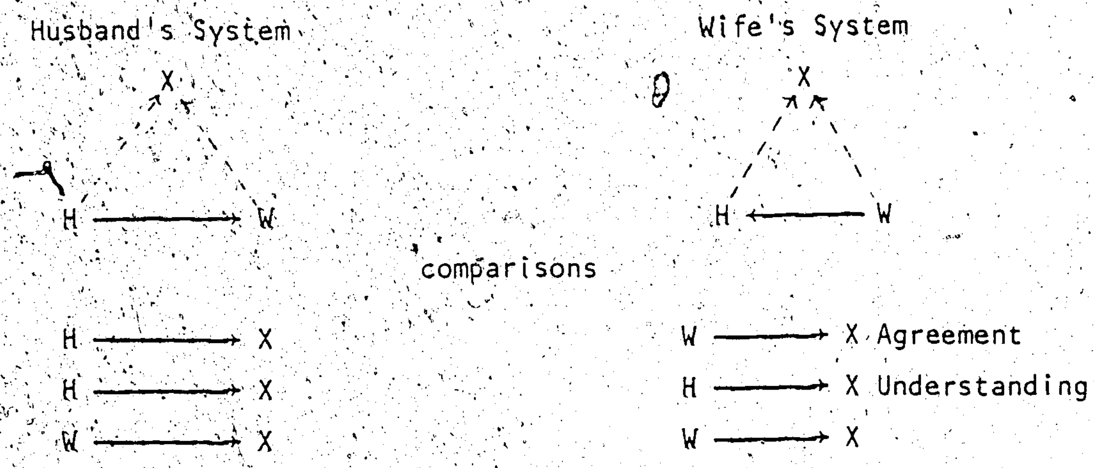


Figure 5.8. Agreement and Understanding Comparisons

husband or wife may compare their agreement on an issue. Hence, there exist two types of comparisons, one performed by the analysis of the researcher and the other performed by the perception of a dyad member. These two types of comparisons are illustrated in the following table:

Table 5.5. Types of Comparisons

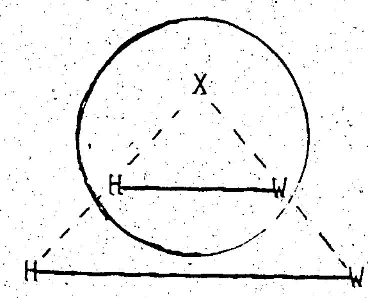
Husband's System		Wife's System
H - - - X	agreement	W - - - X
H - - - X W - - - X	understanding	H - - - X W - - - X
H - - - H - - - X W - - - H - - - X	perceived[7] agreement	W - - - X W - - - X
H - - - H - - - X W - - - W - - - X	perceived understanding (realization)	H - - - X W - - - X

Table 5.5 illustrates that formally understanding and perceived agreement

[7]Alperson (1975:642) translates perceived agreement as "H expects W to agree with him."

are not the same comparisons. However, both of these comparisons may be diagrammed in the familiar H-W-X triangle. The issue of realization is different. It cannot be diagrammed in the familiar way, and instead must be expressed in some other form. This is also true of any higher levels of perception such as level IV, V, etc. Although Laing, Phillipson and Lee do not speculate about such levels, there is no theoretical reason given that would indicate their lack of importance.[8]

However, in terms of higher levels of perception, the Newcomb model can generate these levels recursively. For instance, the triangular graph can accommodate higher levels of perception by viewing X as a complete system of orientation (or any part thereof) which is the object of a system of orientation. To make this more clear it is diagrammed as follows:



[where the part circled is now the issue (X)]

Figure 5.9. Second Order Level of Perception

Such a recursive operation of the Newcomb model generates Level III and IV perceptions in line with the way in which they are conceived in the IPM. Furthermore, the conjoining of these two perspectives adds "affect" to the Laing, Phillipson and Lee perspective, and a measurement technique (IPM) by which the cognitive dimensions of the Newcomb model may be assessed.

The choice of using balance theory in conjunction with that

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[8]This was pointed out in a private communication with L. Larson.

proposed by Laing, Phillipson and Lee, is justified on the grounds that this approach ties Laing's work in with a well-established social psychological theory. Balance theory not only allows the measurement of balance on the individual system but facilitates the aggregation of individuals into the relationships or collective system. The comparisons of agreement, understanding and perceived agreement are compatible with the balance theory H-W-X model. The conjoining of the IPM formulation with balance theory makes possible the measurement of interpersonal perception as well as individual and relationship balance. These two measurements are useful because in some relationships people disagree but still maintain balanced and harmonious relationships. In other words, the individual system is characterized by the variables of balance (equilibrium) and phenomenal perception. The relationship is characterized by balance.

What is missing from the previous discussion is the place these systems and these variables play in the dyadic system. The theory thus far developed must be shown to predict other measurable phenomena. It is to this end that attention is directed first to the prediction of dyadic change, and then to dyadic communication.

5.3 Dyadic Change

Change comes about in the dyad when individuals or the relationship are imbalanced and seek changes which will be balanced. Perception and affect compose the individual system, and are thus the elements of balance or imbalance. In terms of the aggregation of the individual systems of orientation into the collective system of orientation, the elements are the same. These elements have previously been related to both the IPM perceptual comparisons and balance theory. Since the elements are the same for both, there seems an obvious connection. This section seeks to make the theoretical connection between agreement and understanding and balance more explicit, as well as to present the process of change in the dyad.

Two people can agree but not know they agree. They may think that they disagree. They might disagree on other issues but think they agree. The interplay between actual agreement and perceived agreement is an important mechanism for both Laing and balance theory. The conjunction or disjunction between perceived agreement and actual agreement indicates which state, balance or imbalance, the collective system is in. Actual agreement and perceived agreement are represented by the systems comparisons in Figures 5.10 and 5.11.

If the couple actually agrees, but one of the two perceives disagreement, then the relationship (collective system) is imbalanced due to the one individual's imbalance (assuming affect to be positive). If the couple agrees, but both perceive disagreement--as in Figure 5.12--the relationship is in balance in a complementary way as previously discussed with the example of housework $(I \cdot I \overset{?}{=} B)$. And if the couple disagrees, but one thinks they agree, the relationship is imbalanced by the one's misperception. Thus, assuming the affect to be positive, whenever there is a sign discrepancy between one person's perception of X and his perceived agreement with the other, and the other is not discrepant, then an imbalanced relationship exists.

The Relation between understanding[9] and balance is perhaps more

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[9]Some confusion may result in that the term "understanding" is being used differently from the way Laing and his associates use the term. Here, "understanding" means the comparison of signs between the perceptual relations of both individuals. In Laing, Phillipson and Lee (1966:21), "understanding" referred to what is termed in this paper "perceived agreement."

actual agreement;

husband's system	wife's system
H - - → X	W - - → X

perceived agreement;

husband's system	wife's system
H - - → X	H - - → X
W - - → X	W - - → X

Husband | Wife

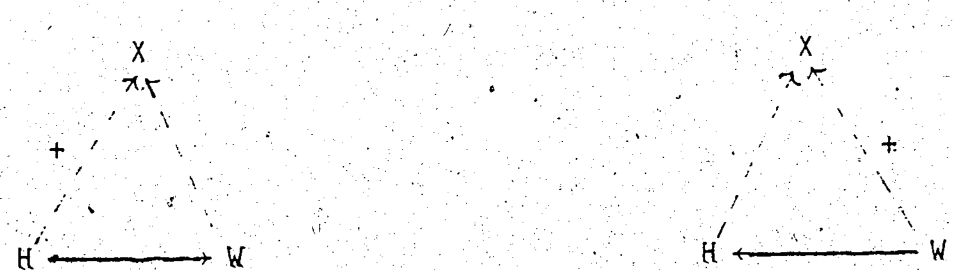

Figure 5.10. Actual and Perceived Agreement

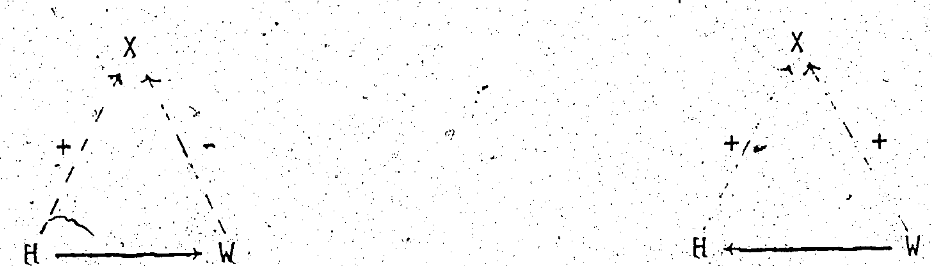

Figure 5.11. Perceived Disagreement

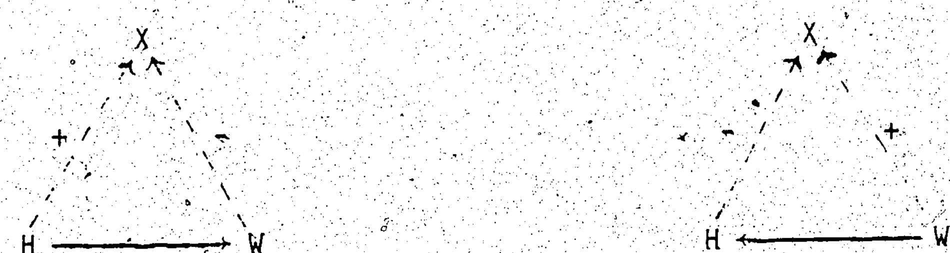

Figure 5.12. Agreement and Perceived Disagreement

important since it summarizes the relations between agreement and perceived agreement. Understanding is the comparison between H - - - X and W - - - X of one individual system with the corresponding relation in the other individual system. If H - - - X of the husband and H - - - X of the wife are the same sign, and W - - - X of the husband and W - - - X of the wife are also of the same sign; then there exists complete understanding. In other words, complete understanding is when the husband accurately knows the wife's perception of X and vice versa. Note that understanding, as diagrammed below, always yields a totally positive balanced relationship. In other words, an understanding relationship is a positively balanced relationship.

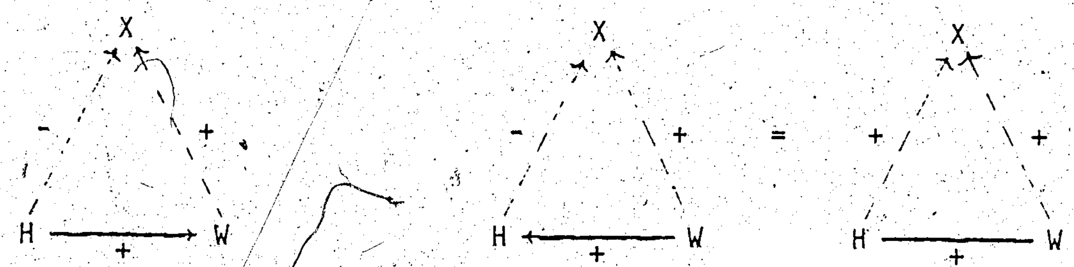

Figure 5.13. Understanding

To summarize the previous discussion: imbalanced relationships indicate that one of the individuals disagrees and misperceives disagreement given that affect is positive. Or, rather, misunderstandings are the conjunction of perceived disagreement and actual disagreement.

In order to discuss change in the dyad, it is necessary to specify the states that individual systems of orientation and relationships (collective systems) can occupy. These can be expressed as follows, in Table 5.6, where affect is positive.[10]

Table 5.6 represents a partial typology of the balanced states the

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[10]Affect is not varied in this typology since the focus of the discussion is interpersonal perception. However, a complete typological representation would have to consider negative affect as well. See Appendix I.

Table 5.6. A Partial Typology of Balanced Systems

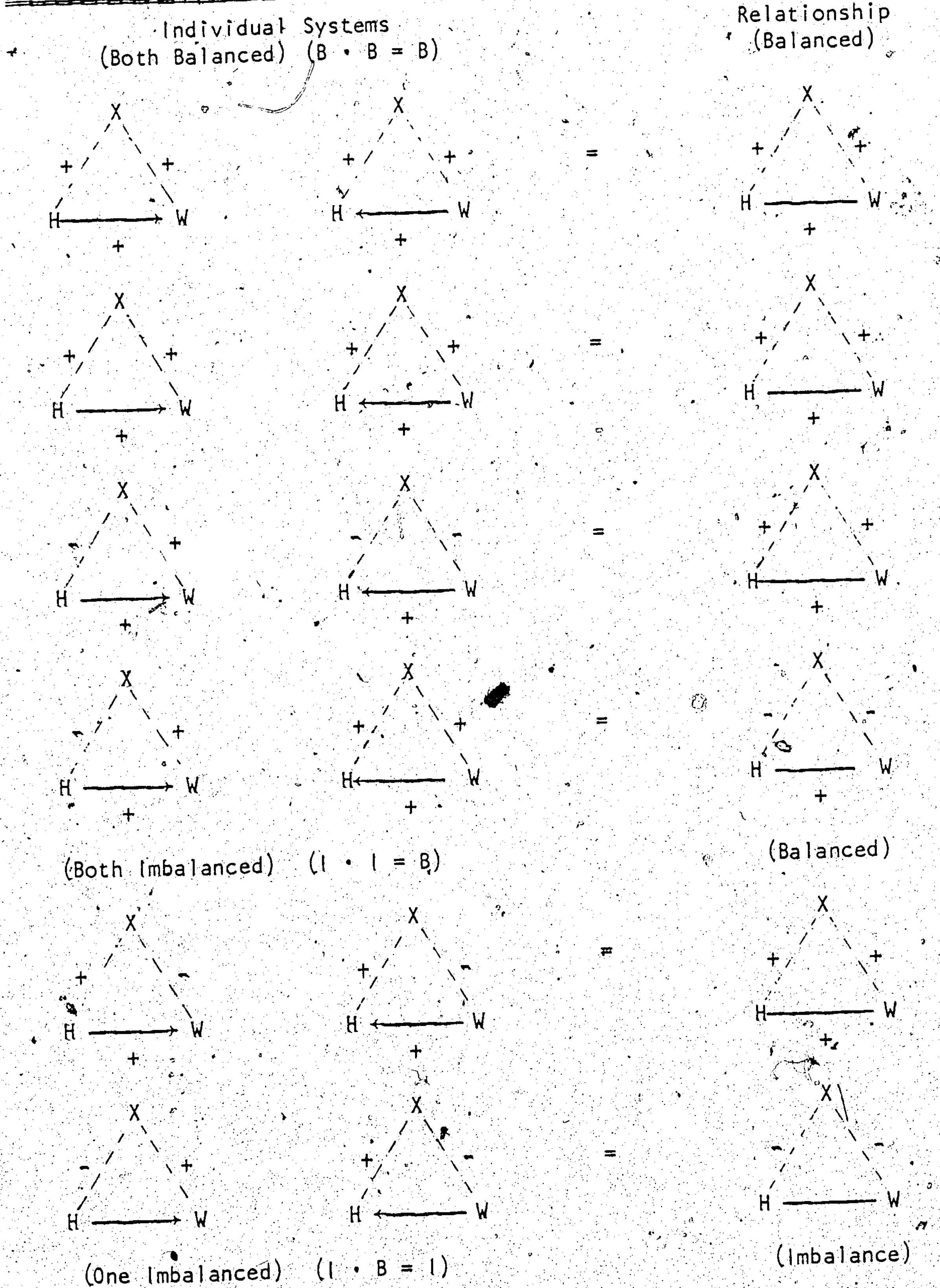
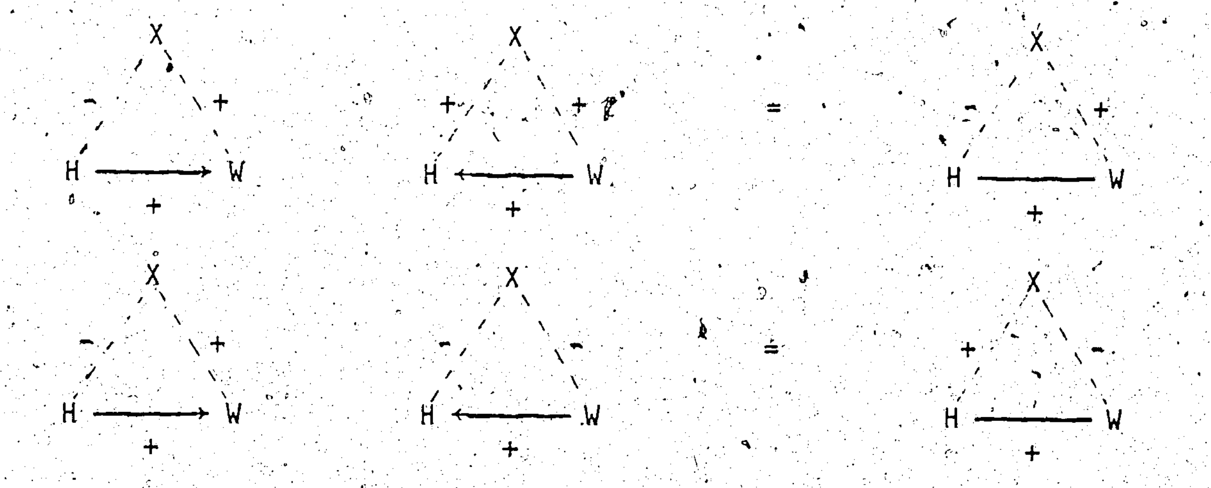


Table 5.6. (continued)



individual and collective systems may assume. From this diagram it may be noted that two individuals may be imbalanced but the relationship may be balanced (I · I = B). According to balance theory, the individuals' state of imbalance directs them to seek balance on the individual level. However, if one individual changes to a balanced state, and the other remains imbalanced (though seeking balance), the relationship will then become imbalanced (I · B = I). An example of this is where the husband and wife disagree on X but perceive their disagreement. In other words, they understand one another as is indicated by the positive balance of the collective system. The change of one of these individuals to a balanced individual system destroys the understanding and the balance of the relationship. In order to maintain balance in the relationship both individuals must change in the same direction simultaneously. This, however, is empirically unlikely. It is more probable that individuals change at different times and that they respond to the imbalance in the relationship by seeking a state of balance in the relationship. Change in this perspective of the dyad is a dynamic interplay of responses to imbalance on the individual level and collective level.

At this point in the discussion, it is necessary to assert as axiomatic that individuals respond to imbalance in the individual system and relationship system (collective) by seeking balance. On the individual system level, balance can be interpreted as perceptual and affective congruity. However, the collective system is quite different. It cannot be claimed that the individual is aware of the imbalance in the relationship in the same way that he is aware of imbalance between his own feelings and perceptions. Rather, imbalance in the relationship emerges as a feeling about interaction and communication with the other. The feeling that there is tension between two people may be paralleled by the feeling of incongruity or tension between perceptions and affect on the individual system level.[11]

Knowing that imbalance disposes the individual to change either the individual or collective system is not sufficient as a prediction. In order to predict the direction of change, an axiom must be added to the balance axiom. This is that ". . . the order of preference for paths toward restoring an unbalanced structure to balance will correspond to an ordering of the paths to the number of sign changes required, from the least to the most . . ." (Rosenberg and Abelson, 1960:128). In other words, this is the principle of least cost. This principle applied to an imbalanced triad assumes that changes will be preferred that change the least number of signs. So the preferred change is to change the sign of one relation only as long as the result is a balanced structure. The complexity of applying this to the two systems, individual and relationship, are not that great. The change will occur so that the minimum

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[11]Taylor (1970) provides an interesting discussion of tension and tension reduction in individual systems of orientation.

number of signs must be altered to bring both systems into balance. An example of such a situation is the following:

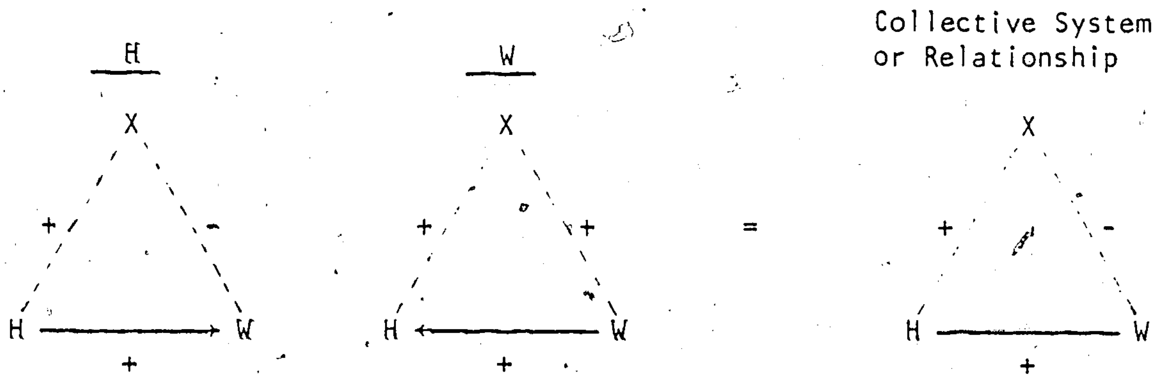

Figure 5.14. Predicting Change in the System

The element that is predicted to change is the husband's perception of his wife's view of X. Once this is changed, following the least cost principle, balance is achieved in all three systems.

In summary, then, change occurs in a dyad when either the individual system of orientation or the collective (relationship) system is in a state of imbalance. A state of imbalance produces tension in the individual or relationship which is reduced by changing the sign of one or more elements so that balance is achieved. In addition to the balance of a relationship, dyads are characterized as being understanding relationships. An understanding relationship is indicated by the positive sign of all elements in the collective system. The direction of change from a state of imbalance is given by applying the principle of least costs to the individual and relationship system. The individual will prefer changes that result in the balance of both the individual and collective systems.

The notion of understanding can be used to order the various individual and relationship states since it is an aggregate representation of the individual states. Formally, there are two distinguishable types of understanding. One type is where the individual systems are positively balanced and the relationship is positive. The other type of understanding is where the two individuals' systems are imbalanced but the relationship is positively balanced. These are represented in Table 5.7. The strongest structure of these eight is where all signs are positive in both individual systems as well as the relationship. This is because there exists agreement, understanding and positive affect. The hypothesis regarding the tendency toward positive relations has been suggested by others (Taylor, 1970). Intuitively this makes sense, especially in the case of negative affect. This additional condition would then imply that the goal state of the dyad is one of positive balance for both the individual structures and the relationship.

Table 5.7. Two Types of Positive Relationships

B • B = +B				I • I = +B			
+ △ + +	+ △ + +	=	+ △ + +	− △ − −	− △ − −	=	+ △ + +
− △ − +	− △ − +	=	+ △ + +	+ △ + −	+ △ + −	=	+ △ + +
− △ + −	− △ + −	=	+ △ + +	− △ + +	− △ + +	=	+ △ + +
+ △ − −	+ △ − −	=	+ △ + +	+ △ − +	+ △ − +	=	+ △ + +

Using this additional assumption of positivity of structure, it is possible to order the dyadic structures. Since the goal state of the system is for a positively balanced dyadic structure, the other dyadic states can be ordered as to their distance from the goal state. The distance from a completely positive dyadic structure is simply given by the number of sign changes necessary to achieve positive balance. Such a reordering means that negatively imbalanced individual systems which are understanding relationships $(-\underset{-}{\Delta}- \quad -\underset{-}{\Delta}- \quad = +\underset{+}{\Delta}+)$ are the farthest distance from the goal state of a positively balanced structure. Previously, Table 5.6 only partially represented the structures of the dyad. Table 5.8 represents the number of possibilities for each structure of the dyad. The total number of possible dyadic structures is 64. These structures, as presented in Table 5.8, give no idea as to the distance a structure might be from the totally positive structure. It is thus necessary to rearrange this typology to indicate the distance or number of sign changes necessary.

Table 5.8. Possibilities for Dyadic Structures

B • B = +B	4
B • B = B	12
B • I = I	16
I • B = I	16
I • I = B	12
I • I = +B	4
	64

Table 5.9 presents the state structures along with the number of sign changes required before complete positive balance is achieved. Table 5.9 presents some interesting anomalies. One such anomaly, as previously discussed, is that a positively balanced relationship (understanding) is six steps away from complete positive balance. The step before the goal

state is one of imbalance for both an individual and the relationship. This seems to highlight the dialectical nature of the state structures between harmony and discord. If the sign changes were conceived as steps in the process, then the third step would be the modal category containing 20 of the 64 state structures. Interestingly enough, this modal category is not one of harmony but, rather, imbalance. Another interesting detail is that, as the system moves from the state where six changes are required, there is a corresponding reduction in the degrees of freedom for each state structure. This is to say that there is more freedom in terms of which relation to change to a positive sign in the case where there are six negative signs than in the case where there is only one negative sign.

Table 5.9. Sign Changes Required for State Structures

Sign Changes	State Structures	Frequency
0	+B +B = +B	1
1	B I = I	3
	I B = I	3
2	B B = B	6
	I I = B	9
3	B I = I	10
	I B = I	10
4	B B = B	9
	I I = B	6
5	B I = I	3
	I B = I	3
6	-I -I = +B	1

The assumption that a completely positive state structure is the goal state of the system and that, once it is achieved, the system does not return to the other states, but remains in the completely positive state unless acted upon by exogenous variables, implies a stochastic process known as an absorbing "random walk" or an absorbing Markov chain. The Markov process has been identified by Flament (1963) as the underlying model of the balancing process. Nahinsky (1969) also considers group interaction as a balancing process modelled by a Markov chain. Nahinsky (1969) suggests that dyadic change is similar to a stochastic process. However, both Flament (1963) and Nahinsky (1969) fail to develop insights to the point of determining the transition matrix. In other words, these authors suggest the stochastic modelling of the balancing process and dyadic change but do not go into a detailed consideration of a particular system.

A finite Markov process is composed of a finite set of states or events. The occurrence of any one state is only dependent upon the state that preceded it. An example of this is found in Table 5.9, where the chances of moving in one sign change from B • B = B to +B • +B = +B are nil as compared with the chances when the preceding state is B • I = I instead of B • B = B. The dyadic system moves from state structure to state structure like a Markov chain. However, as Flament (1963) has pointed out, the balancing process is a particular kind of Markov chain; one called an "absorbing" Markov chain.

A Markov chain can be considered to be an "absorbing" process if it contains at least one state from which it is impossible to leave. The "absorbing" Markov chain is quite distinct from both regular and ergodic chains. A regular Markov chain is defined as a chain in which some power of the probability matrix has only positive entries. Technically, it is impossible for an absorbing chain to be a regular chain, since the row of the absorbing state contains all zero elements except for the absorbing state which is one. For this same reason the absorbing chain is distinct from ergodic chains. An ergodic chain is one in which it is possible to go from any state to every other state though not necessarily in one step.[12] There are some absorbing Markov chains in which it is not possible to go from every state to the absorbing state in a finite number of steps. However, the model developed in this paper is the type of absorbing Markov chain in which it is possible to move from any starting state to the absorbing state in a finite number of steps. In terms of the balancing process, the completely positive state of +B · +B = +B acts as an absorbing state. That is, once the dyad enters this state structure it is in a state of complete balance or equilibrium unless acted upon by exogenous effects.

It is possible to reach the absorbing state of completely positive balance from any other state structure. In fact, if the system were completely determined, then, according to Table 5.9, the absorbing state could always be attained in six steps. However, as with an equilibrating system such as homeostats, there are a number of variables internal to the dyadic system that interfere and the system experiences some oscillation. In the dyadic system, the oscillation about the goal state is due to factors such as the time taken to transmit information between two individuals as well as the accuracy of the messages communicated. These communication variables will be considered shortly. The present point is that the dyadic system is not a strictly determined system but rather a probabilistic system. As well, there are measurement reasons such as

[12]See Kemeny, Snell and Thompson (1956), Chapter 6, pp. 384-411.

aggregation why the dyadic system should be considered as probabilistic. These are more fully discussed in Chapter VI.

The balancing process can be modelled as an absorbing Markov chain only if the probabilities of moving from one state to another can be computed. Table 5.9 allows the computation of these apriori probabilities, since the frequency of states at each level of sign change represents the set of possibilities of a transition from any given state to another. As has been previously noted, it is impossible to move from B • B = B to +B • +B = +B in one step. Thus, the transition probability between these two states is zero. The other transition probabilities can be computed in the same way (see Appendix I for more detail). The result of these computations is a transition matrix for the six dyadic state structures. The transition matrix in Table 5.10 represents an absorbing Markov chain. Note that state +B • +B = +B has a probability of one and, therefore, is the absorbing state of the system. The transition probabilities in Table 5.10 give the probability of moving from one state to another. Thus, if a dyadic system is in state structure B • I = I, then the most probable next state structure is either I • I = B (.454) or B • B = B (.454). Only 9% of the time will a dyad move from B • I = I to +B • +B = +B. This means that before a dyad reaches a completely balanced state it will oscillate a large number of times between four states. Thus far the dyadic state structures have referred to balance on only one issue. However, as indicated by the IPM's 60 relationship issues, there are many relationship issues salient in a dyad at any one time. Each of these issues follows the balancing process indicated by the Markov chain. This implies that, on the aggregate level of all salient issues at a given time, the goal state is unlikely to be

Table 5.10. Transition Matrix for Dyadic State Structures

	+B • +B = +B	B • I = I	I • B = I	I • I = B	B • B = B	I • I = +B
+B • +B = +B	1					
B • I = I	.09			.454	.454	
I • B = I	.09			.454	.454	
I • I = B		.5	.5			
B • B = B		.5	.5			
I • I = +B		.5	.5			

achieved simultaneously in all of these issue balancing processes.

The transition matrix in Table 5.10 represents a Markov chain that is neither ergodic nor a regular Markov process. An ergodic chain is one in which it is possible to move from every state to every other state although not necessarily in only one step. A subset of ergodic chains are regular chains. A regular Markov chain is one where some power of the transition matrix has all positive entries. Obviously, if a chain is not ergodic then it is not regular. The transition matrix in Table 5.10 is not ergodic because it is impossible to move into the state I • I = +B from any of the states. Theoretically, this implies that this one state structure can only be a starting state. Intuitively, this state can be interpreted as where the two individuals hate the same things and dislike each other. However, there is the paradox that out of such a conjoining of two individual systems of orientation there is the relationship state of understanding. It is difficult to imagine that any dyad would, in fact, survive for long if the members continued in this state of negativity and dislike of one another. Hence, it is understandable that if a dyad is going to exist at time two they will have moved from this negative state structure to some other state structure, as indicated by the transition matrix.

An absorbing Markov chain, such as the one in Table 5.10, can yield even more information regarding the balancing process in the dyad. For instance, over a sufficiently great amount of time, the balancing process will tend toward absorption. It is possible to calculate the number of times the process is in each state before it is absorbed. These calculations involve finding the fundamental matrix N (see Appendix I). The fundamental matrix N presented in Table 5.11 gives the average number of times that the balancing process will be in each nonabsorbing state before it is absorbed. Hence, the average number of times the process moves from B • I = I to B • I = I is 5.9 times. The average number of times the process moves from B • I = I to I • B = I is 4.9 times. Matrix N, then, actually presents the means for the process being in each state. Adding across the rows of matrix N [i.e., N (C)] the sums yield the total number of times on the average that a given state will occur before absorption. This operation, for example, indicates that state B • I = I will occur on the average 20.7 times before absorption. As would be expected, these averages are roughly similar, indicating that approximately 21 transitions will occur before reaching the absorption state of completely positive balance.

Table 5.11. Fundamental Matrix N

Dyadic State Structures	B • I = I	I • B = I	I • I = B	B • B = B	I • I = +B	N (C)
B • I = I	5.9	4.9	4.9	4.9	0	20.7
I • B = I	4.9	5.9	4.9	4.9	0	20.7
I • I = B	5.4	5.4	5.9	4.9	0	21.7
B • B = B	5.4	5.4	4.9	5.9	0	21.7
I • I = +B	5.4	5.4	4.9	4.9	1	21.7

Thus far, the discussion of dyadic states has conceptualized these states for only one issue. That is, the individual systems of orientation and the relationship system are considered in terms of balance or understanding, respectively, for each issue. Although the IPM decomposes a dyadic relationship into 60 issues, it is doubtful that a consideration of only one issue will reveal very much about the relationship. However, it is possible to deal with the average dyadic state at any one time. This distinction is that the dyadic state for one issue represents a microstate of the process, whereas the dyadic state averaged over 60 issues represents a macrostate of the process. The Markov chain, previously discussed for microstates, is equally applicable to the macrostate process, since the transition probabilities are a function of the theoretical distribution of states regardless of issue or issues. Thus the Markov chain stands as an analytic model of the balancing process.

5.4 Communication in the Dyad

All dyadic change comes about by the changing of one or more signs of the state structure. This change of signs develops a different state structure, and this transition process from one state structure to another over time is modelled by the Markov chain. The process shifts from state structure to state structure until an equilibrium state is reached.

In terms of everyday experiences, the process of transitions from state structure to state structure is a process of communication. For instance, examine the change from B · I = I to +B · +B = +B where there exists only one negative component in I. If the husband is balanced and the wife imbalanced, then, according to the principles of least costs and positivity, the wife should change her negative sign to a positive. The situation may be as diagrammed in Figure 5.15. In Figure 5.15, the husband accurately perceives the wife's attitude toward X but she misperceives the husband's attitude toward X. She believes that her husband dislikes X when, in fact, he likes X. If it were possible to encapsulate the wife in complete isolation from stimuli at this point, it is doubtful that she would change her perception. In other words, the change of perception occurs when new information becomes available. If the wife were to be in isolation, then there would be no reason for her to doubt that her perception is incorrect. However, while she is in isolation, if she is told that her husband exhibits some behavior that indicates liking X, then there is reason for her to reevaluate her perception. Hence, sign changes are a function of received information.

Hu	Wi		Relationship
X	X		
+ △ +	− △ +	=	− △ +
H + W	H + W		− +

Figure 5.15. Imbalanced Structure

In the example presented in Figure 5.15, it is undoubtedly the case that the wife would prefer a balanced individual system of orientation to one that is imbalanced. In this sense imbalance predisposes the individual to change and, thus, predisposes the individual to be more receptive to information. Imagine the condition as in Figure 5.16. In this case, the husband mistakenly perceives the wife's attitude toward X to be positive when it is actually negative. However, she is in an imbalanced state and, hence, more predisposed toward change than her husband who is positively balanced. Although her perception is veridical and his mistaken, the wife is more likely to change than is the husband, since her individual system is imbalanced. This is to say that the degree of positive balance represents the degree of impedence to receiving information about an issue. Thus, the greater the degree of positive balance in an individual system, the less receptive that system is to information about the issue. This implies that the dyadic state structure of complete positive balance is totally resistant to information about an issue. On the other hand, the state structure of two completely negative individual systems indicates that there is a maximum receptivity or, rather, a minimum impedence to the reception of information about an issue (see Chapter VI).

Hu		Wi		Relationship
+ △ +		+ △ −	=	+ △ −
+		+		+

Figure 5.16. Misperception and Imbalanced Structure

When information is received, the reception is indicated by the selective function. Received information functions so as to select from the set of possible states of the receiver. For example, imagine that the individual system of the receiver is in a totally negative state of imbalance. The individual receiver could either remain in that state or change to any of seven other individual states as in Figure 5.17. In this example there are eight possible states and, hence, $\log_2 8$ or three bits of information needed to reduce the uncertainty if all states are equally probable. If both individual systems are joined in a dyad, and they are independent, then the uncertainty in the dyad is simply the product of the individual systems, hence, $\log_2 8 + \log_2 8 = \log_2 16$ or four bits of uncertainty.

− △ −	+ △ −	− △ +	− △ −	+ △ −	− △ +	+ △ +	+ △ +
−	−	−	+	+	+	−	+

Figure 5.17. Possible Individual System States

However, these states are not equally probable. The probabilities change with the degree of balance, positivity, least costs, and the state of the other individual systems in the dyad. Obviously, every time an individual system changes, the dyadic system, likewise, changes. There are a total of 64 possible dyadic states. The uncertainty in the dyadic system is $\log_2 64$ or six bits if these states are equally probable. However, in terms of the theory advanced thus far, these states are not equally probable. There is variation within each state structure according to the uncertainty of a transition to the next state. It was previously stated that the number of sign changes necessary before moving into the absorbing state acted similarly to the degrees of freedom for that state. Actually, the uncertainty (df) for each state is given by one minus the number of negative signs in that state. For example, if the state is $+ \underset{+}{\Delta} + \cdot + \underset{+}{\Delta} - = + \underset{+}{\Delta} +$, then there is no freedom since it is obvious that, according to the theory, the one negative sign will become positive. In states where there are two negative signs, there is one degree of freedom; three negative signs, two degrees of freedom; and so on. Hence, the actual uncertainty for the dyadic system must be computed by the uncertainty in the state weighted by the state's probability of occurrence in the system. Table 5.12 shows that there are approximately two bits of uncertainty in the dyadic system. This can be compared to the six bits of uncertainty in an equally probable system. The interpretation of this comparison is that the equally probable system represents the case of greatest uncertainty for the dyadic system and, reciprocally, the most freedom of choice. A measure is available which compares the uncertainty of these two systems. Redundancy is present when a system is so ordered that information about its structure at one time overlaps with the information about its structure at the next time. To put it another way, redundancy is a measure of the predictability of the system. In the dyadic system represented in Table 5.12, redundancy is about 66-2/3%. This means that there is only 33-1/3% freedom of choice in the dyadic

Table 5.12. Uncertainty for the Dyadic System

State Structure	df	Probability	Uncertainty (bits)
+B · +B = +B	0	1/64	0
+B · I = I	0	3/64	
	2	10/64	.3125
	4	3/64	.1875
			0.5
I · B = I			0.5
B · B = B	1	6/64	.0937
	3	9/64	.4218
			0.515
I · I = B	1	9/64	.141
	3	6/64	.2811
			0.4221
I · I = +B	5	1/64	.078
			Σ 2.015

system. In other words, over time only 1/3 of the messages in this system carries information, since redundant messages have no information value in terms of the selective function in the receiver.

Information is only that part of the message that performs the selective function in the receiver. In a closed dyadic system, about 66-2/3% of the messages transmitted will be distributed as a function of the uncertainty of the state structures. Hence, over a sufficiently long period of time, the distribution of 66-2/3% of the messages would approximate the proportions in Table 5.13. Table 5.13 presents the probabilities of information (i.e., message - redundancy). This assumes that the amount of uncertainty in any given state relative to the total uncertainty of the system gives the probability (proportion) of information transmission over a period of time.

Table 5.13. Proportions of Information Distribution

State Structure	Uncertainty	Proportion (Pr)
+B · +B = +B	0	0
B · l = l	.5	.25
l · B = l	.5	.25
B · B = B	.515	.257
l · l = B	.4221	.21
l · l = +B	.078	.04
	2.02	1.00 (1.007)

The information that is transmitted in a dyadic system may be of two kinds. In the case illustrated in Figure 5.16 (p. 109), there is little need for communication since, according to positivity and least costs, there is no freedom in this particular state. That is, the one minus should necessarily transform to a plus. However, in the case represented in Figure 5.18, there is at least one degree of freedom and, thus, some call for communication. In this example the imbalance is maintained by the individuals' attitudes toward X and their perception of the other's attitude toward X. Communication is undoubtedly going to be concerned with cognitions about X. For instance, the husband might tell his wife that he doesn't like X, which would then select for a different state in the wife's system of orientation in which she now sees that her husband doesn't like X, instead of her previous perception that he does like X. Of course, other communications are possible but all of these share the common feature that they are communications about the cognitions of X.

- Δ +	+ Δ -	=	- Δ -
+	+		+

Figure 5.18. Cognitively Imbalanced Structure

The other type of communication is illustrated in the diagram below in Figure 5.19. In this example, the wife's communication to the husband will be about cognitive elements since that is the area of negativity for her. However, the husband is more likely to communicate about his affect. He feels negative affect for his wife and, hence, is likely to express this negative affect in his communication.

Hu	Wi		Relationship
+ Δ +	- Δ +	=	- Δ +
-	+		-

Figure 5.19. Affectively Imbalanced Structure

The two types of communication correspond to the two types of relations. There are relations between a person and objects; these are cognitive elements or cognitions. Also, there are relations between two persons; these are affective elements or, simply, affect.

If the sender of a message is in a state of imbalance where one or both cognitions are negative, then communication will concern cognitions. On the other hand, if the negative element is affective, then communication will express affect. 'In terms of the IPM, and the earlier discussion of balance and understanding where the object (X) is a statement about the relationship; then the cognition is the truth function of that statement, and affect is the positive or negative sentiment on the dimension with which the statement is concerned. For example, if the statement is that the husband loves the wife, then the cognition is the truth value the husband and wife independently assign to the corresponding statement that "My spouse believes that the statement 'husband loves wife' is true." Both of these are cognitions. The affect is the sentiment of love expressed between the husband and wife.

When cognitions are negative in sign or imbalanced, then communication will result. However, as information theory points out, the sender of a message will design the message so that it is intended to select for a certain state in the receiver. Examine the situation in Figure 5.20. In this example, the husband knows that his wife doesn't like X. In order to change his imbalance he must change his wife. This is to assert that, unless the husband denies his own perception, he must then change his wife's state so that he can become balanced. The husband must communicate to the wife that she should like X. Both the husband's and wife's positive balance, as well as the relationship, depend on the wife's change of state. Imagine that the wife decides to like X. Now, she must communicate this change to the husband in order for him to change his perception of her attitude to positive and, thus, place the dyad in a completely balanced state in regard to this particular issue. This is an example of the selective function of information.

Hu		Wi		Relationship
+ △ −	•	+ △ −	=	+ △ +
+		+		+

Figure 5.20. Imbalanced Individuals and Balanced Relationship

The expression of affect is a slightly different matter from that of cognition. It is interesting that whenever communication is *about* affect, such as love, it is necessarily a cognition about an issue which happens to be affective. This implies that affect cannot be encoded digitally as an object but can only be communicated via analogic codes that actually give the feeling iconically. This has already been noted by Watzlawick, Beavin and Jackson. According to these authors, cognitions are encoded digitally (information about objects); whereas, affect (relationship) is coded analogically.

> On the one hand there can be no doubt that man communicates digitally. In fact, most, if not all, of his civilized achievements would be unthinkable without his having evolved digital language. This is particularly important for the sharing of the information about *objects* and for the time-binding function of the transmission of knowledge. And yet there exists a vast area where we rely almost exclusively on analogic communication, often with very little change from the analogic inheritance handed down to us from our mammalian ancestors. This is the area of *relationship* [italics in original] (Watzlawick, Beavin and Jackson, 1967:63).

Furthermore, Gottman, Markman and Notarius (1977) use the same argument for distinguishing affect.

Previously (in Chapter IV), it has been argued that not all messages which are encoded digitally are sent verbally; and, as well, not all messages encoded analogically are sent on nonverbal channels (see Table 4.2). However, the exceptions are so few as to make this a relatively safe generalization. That is that digital messages (cognitions) are sent via verbal channels, whereas analog messages (affect) are sent via nonverbal channels such as gestures and intonation. This generalization is further supported by the coding systems for communication behavior used by Gottman, Markman and Notarius (1977) and Mehrabian (1972).

The difference between the communication of affect and the communication of cognition is rather marked. The amount of information about affect is a function of how much uncertainty there is in a given state. More precisely, it is a function of the probability of negative affect in the dyadic state. The greater the probability of negative affect in a state structure, then, the more likely will be the occurrence of intentional nonverbal communication. Likewise, the greater the probability of negative cognition in a state structure, the more likely will be the occurrence of verbal communication. Since uncertainty is measured by the number of sign changes necessary to reach the absorbing state, negative affect and negative cognition must compose the basis of uncertainty. In other words, it is possible to decompose uncertainty for each state structure into the proportion of uncertainty for negative affect, and that proportion for negative cognition, and that proportion shared by both.

Table 5.14 shows that the bulk of the uncertainty in each state structure is contained in those states that have both negative affect and negative cognition present. This implies that for the most part communication should be composed by the use of both the nonverbal (affect) channels and verbal (cognitive) channels. However, state structure I · I = B appears as an exception. The other state structures have 80% or more of their states in the conjunction of negative affect and negative cognition. But state structure I · I = B only has 66% of its states in the conjunction. For this particular state structure (I · I = B), about 27% of the states has negative cognitions without any negative affect, and about 07% of the states in this structure have negative affect with no negative cognition.

From the fundamental matrix N of the balancing process (Table 5.11), the state structure I · I = B occurs on the average 5.4 times

Table 5.14. Proportional Distribution of Uncertainty for Negative Affect and Negative Cognition

State Structure	Negative Affect (bits)	Negative Cognition (bits)	Negative Affect and Cognition (bits)	Total (bits)
+B · +B = +B	0	0	0	0
B · I = I	.031	.0625	.406	0.5
I · B = I	.031	.0625	.406	0.5
B · B = B	0	.103	.412	0.515
I · I = B	.028	.112	.281	0.4221
I · I = +B	0	0	.078	0.078

starting from any of the states. This means that on the average there are only about 1.4 times in the process that communication is verbal but affectively neutral. In these few instances, communication is expected to follow the verbal channel with only some random noise on the nonverbal channel. The assumption is that the noise on the nonverbal channel is distributed about the neutral value of affect. Hence, over a sufficient number of trials, the average number of times that there is verbal communication, but no intentional nonverbal communication, would be about 27% of the number of times state structure I · I = B occurs, whereas, the whole process would exhibit this communication pattern only 17% of the time. Furthermore, there should only be nonverbal without verbal communication in less than 5% of the states of the balancing process.

In summary, this chapter presents a formal model of interpersonal perception and communication. This model is constructed from the graph theoretical interpretation of balance theory and the IPM. Following the suggestion by Flament (1963), the balancing process is conceived as a finite absorbing Markov chain. Conceptually, the Markov model is similar to the perceptual model suggested by Powers (1973) in that both are homeostatic.

The picture that is developed of interpersonal perception and communication is for a closed dyadic system. In this system, one person (A) communicates with another person (B) by either verbal or nonverbal channels. The communication received by person B performs a selective function by selecting from the set of possible state structures that person B may occupy. Thus, the interpersonal perception of person B is defined at any time as the state structure selected and occupied at that time. The interpersonal perception (state structure) is compared to the goal state of a completely positive state structure. The error or deviation from the goal state prompts person B to communicate to person A the type of change, affect or cognition, and the direction of change, positive or negative. The dependency between the two people is due to the fact that person A cannot change without changing the relationship and, hence, person B as well. The goal-seeking behavior of the system follows the axioms of the balance, positivity, and least costs.

One way to succinctly summarize the discussion in this chapter is to present the arguments as a series of axioms. For the dyadic system these axioms are as follows:

Axiom #1

The individual systems of orientation tend toward a state of complete positive balance.

Theorem #1

The relationship tends toward a state of complete positive balance.

Axiom #2

The order of preference for changing signs in the dyad so as to reach positive balance is from the least number of sign changes to the greatest number (Rosenberg and Abelson, 1960:128).

Theorem #2

The individual seeks changes in the dyad by changing the least number of signs from negative to positive.

Theorem #3

The resistance or impedance to changing a sign in an individual system of orientation is given by the degree of positive balance.

Axiom #3

A change of sign in one individual system of orientation is a function of information from the other.

Definition 1:

Information is that part of a message that selects from a set of possible states in the receiver (selective function).

Definition 2:

Individual systems of orientation can either change the sign of cognitions (perceptions) or affect (feelings).

Axiom #4

Affect is encoded by analog codes and cognitions by digital codes.

Axiom #5

Analog codes are transmitted on nonverbal channels and digital codes are transmitted on verbal channels.

Theorem #4

Affect is communicated by nonverbal channels and cognitions are communicated by verbal channels.

These five axioms and accompanying definitions and theorems are offered in way of summary. However, a complete statement would necessarily include more definitions and theorems than the ones above. Most of these have been introduced in this chapter and should be familiar without reintroduction; for example, the notion of balance.

Although the model and axioms are aimed at interpersonal perceptions and communication in a dyad, they are expandable to larger groups. In the dyadic system there are 64 states. If this is expanded to a triadic system, there are 2^{10} or 1,024 states, and with a quadratic system there are 16,384 states. The solution to this problem lies not in changing the axioms or Markov chain but in the aggregation of these states into state structures. Since the state structures are nothing more than additive typological sets, the state frequencies assume the frunction of probabilities for each state structure. Furthermore, the state structures may vary according to the research question being posed. Hence, the system as proposed for the dyad is expandable to larger groups by the modification of the state structures. The system would seem to have application, especially in cases such as interpersonal perception and communication in families. Even as a dyadic system, family member dyads, such as father-son, husband-wife, mother-son, can be analyzed and compared without modifying the system presented in this chapter.

CHAPTER VI

MEASUREMENT ISSUES

Any theory or model in science is destined to have some empirical application. The empirical application may be in the area of hypothesis testing or, perhaps, as a heuristic device. No matter what type of application, a theory or a model must have a minimal set of measurements that correspond to some of the abstract concepts or symbols. This chapter confronts these measurement issues for the framework previously developed in Chapter V.

6.1 States: Affect and Cognition

Crucial to the measurement of interpersonal perception and communic[illegible] dyad is the measurement of each individual system of orient[illegible] individual system of orientation has three variables. these th[illegible]iables are the affect person A feels for the other, the cognition [illegible]rson A holds toward X, and the cognition person A holds of person B'[illegible]ttitude toward X. The individual system is, therefore, composed of two cognitive variables and one affect variable.

The cognitive variables can be directly measured by the IPM. The correspondence between the cognitive variables and the questions is rather high since the questions are phrased in such a way as to be nearly identical to the concept (see Appendix II). Thus, the face validity of these questions is high. However, as Jahoda (Preface, Laing, Phillipson and Lee, 1966) has pointed out, the individual may only answer these questions in socially desirable ways or answer in nonrevealing ways. Jahoda refutes this criticism of IPM by pointing out that what is crucial is the compar[illegible]n between the answers of two individuals, i.e., the relationship. She states that "It would take an unlikely degree of long practised collusion between two persons for each of them to fill in independently these items to produce a perfectly controlled pretence of agreement throughout" (Laing, Phillipson and Lee, 1966:vi).

Laing, Phillipson and Lee (1966) performed a test-retest reliability check on the IPM. The test-retest interval was four-to-six weeks. It was performed on two samples; 14 disturbed marriages and ten nondisturbed marriages. For the disturbed sample, only five issues out of the 60 showed a lower percentage agreement than 76%. The nondisturbed sample was less uniform in its responses. For the nondisturbed group, over half of the IPM items showed percentage agreements of 91% or higher. As well, this group revealed eight items out of 60 where agreement was 70% or below. In general, then, the test-retest reliability appears adequate. But this method of checking reliability may not be the best. For instance, a married couple undoubtedly changes over time, and four-to-six weeks seems a reasonable amount of time within which changes may occur. A reliability check needs to be performed for a shorter time interval. Furthermore, in order to minimize variation on the test-retest reliability check, Laing, Phillipson and Lee (1966) collapsed their four-valued response scale to a two-valued scale. This technique undoubtedly concealed some of the changes that would be expected over a four-to-six-week interval. From this standpoint, the reliability of the IPM is difficult to assess and another check needs to be done with a shorter time period.

Laing, Phillipson and Lee (1966) have attempted to address the question of internal consistency as well. They compared the agreement for seven pairs of synonymous items. In other words, these pairs were composed of items with a high degree of semantic overlap such as loves: likes or humiliates:belittles. A second set of six pairs of antonymous items such as love:hate were tested as well. The consistency of responses within the IPM was judged by Laing, Phillipson and Lee (1966) as consistent by these measures. Only two pairs showed some inconsistency, and this was mainly due to the disturbed couples' responses. These two inconsistent items are, believes in:doubts, and lets be self:won't let be. However, these two were answered more consistently in the retest and, hence, their original inconsistency might be an anomaly. With such a few items it is difficult to make any but the most cautious conclusions. Undoubtedly, the majority of items in this check for internal consistence were judged by Laing, Phillipson and Lee (1966) as being consistent.

Unlike the case of cognitions where there is a measurement tool available, the case of affect presents greater measurement problems. Since affect refers to the feelings of the individual toward another, these feelings must be measured directly. Any self-report by a respondent necessarily transforms the affect into an object and, hence, it becomes a cognition about the feeling. For example, if the respondent is asked whether or not they love someone, their response is a cognition about their love of the other person and not the feeling. This implies that affect must be measured in some form that does not demand the transformation into a cognition.

One technique that meets these requirements is the use of autonomic indicators. White and Frideres (1976) use this technique to gain an independent measurement of the affect toward an object. Their technique is applicable to the present problem. It allows the measurement of affect for each type of relation measured by the IPM. For example, the IPM gives the cognitive scores for an issue such as love. At the same time the individual is exposed to the item, autonomic measures such as galvanic skin response and heart rate can be monitored. The problem, however, with this type of measurement is that it can only indicate the presence of affect (arousal) or the absence for a given item. But once the direction is inferred, this technique would allow for a measure of the magnitude of affect.

The use of autonomic measures is rather cumbersome since extensive hardware is required. Another technique by which affect may be measured is possible. This technique relies on the definitions and theorems dealing with communication. Recall that affect is encoded by analog codes. Furthermore, analog codes are communicated via the nonverbal channels of communication. This means that the part of nonverbal behavior which is intentional can be used to indicate the affect person A has for another. In order to observe and record the nonverbal behavior, this behavior must be decoded into the appropriate type and direction of affect.

Decoding nonverbal behavior into affect is a troublesome matter. For example, an individual might sarcastically smile at someone for whom they feel contempt. If a decoding system decodes a smile as positive affect, then a measurement error is made in this example. The decoding system would be ideal if it corresponded exactly to the decoding system of the receiver. However, this would be impractical as a method of research. On the one hand a decoding system is needed that is sensitive to the nuances of interpersonal behavior but at the same time does not become subjective to the receiver. In other words, the requirements for an adequate coding system are that it is sensitive to nuances such as sarcasm, and yet decodes nonverbal behaviors as they are commonly received by members of a community.

Quite a few category or notational systems have been developed for the study of nonverbal behavior, such as Kinesics (Birdwhistell, 1970) and Labanotation (Hutchinson, 1970). These notational systems allow for detailed recording of nonverbal behavior. However, such notational systems fail to relate their categories of nonverbal behavior to corresponding information states. That is, in order for the frequency, rate, etc., of certain categories of nonverbal behavior to be theoretically meaningful, they must be decoded into approximately the same information states that would be used by a conventional receiver. In terms of the theoretical interest here, this means that the categories of nonverbal behavior should be related to the values of affect they select in the receiver. In other words, the categories of nonverbal behavior must be decoded into positive, negative or neutral affect.

Mehrabian (1972) develops a coding system for decoding nonverbal behavior into positive, negative or neutral affect. He reports the scoring reliability for each measure varying from 0.95 for physical distance to 0.44 for affect in vocal activity. Following Mehrabian, Gottman, Markman and Notarius (1977) used these codes in the study of couple interaction. These authors coded video-taped sessions of couples for three categories of nonverbal behavior, face, voice and body. In each case, the absence of a positive or negative code is coded as neutral affect. For example, in terms of facial cues ". . . positive facial cues include smile, empathic face, head nod, eye contact. Negative facial cues include frown, sneer, fear, cry, angry face, and disgust"

(Gottman, Markman and Notarius, 1977:465). Gottman, Markman and Notarius found that these nonverbal codes discriminated distressed from nondistressed couples better than verbal behavior. Interestingly, the nondistressed couples communicated more negative affect than the distressed couples.

From an examination of the work of Mehrabian (1972) and Gottman, Markman and Notarius (1977), it seems that affect may be indirectly measured by a nonverbal coding system. Since this coding system contains three values for affect, i.e., positive, negative or neutral, some modification must be made if it is to be used in conjunction with a two-valued graph theory. One possible modification is to turn the two-valued graph theory into a three-valued one. This would mean that instead of 2^6 states there would be 3^6, or instead of 64 there would be 729 states. This would certainly make computations more cumbersome. Another alternative is to collapse the three-valued measurement of affect into a two-valued measurement. The two-valued measurement would be either the presence of affect (positive and negative) or the absence of affect (neutral). This two-valued measurement of affect greatly simplifies coding procedures as well as conforming to the two-valued graph theory. Furthermore, it would seem justified on the grounds of the empirical findings reported by Gottman, Markman and Notarius (1977). They reported that nonverbal behavior discriminated distressed from nondistressed couples better than verbal behavior. However, positive affect did not contribute to this affect. Rather, significant differences were found for the two groups of couples in terms of both neutral and negative affect. Hence, in this particular case it would appear that the presence or absence of affect distinguishes between the two groups.

In summary, the individual system of orientation is composed of two cognitive variables and one affect variable. Each variable may take either of the two values. The measurement of the cognitive variables is obtained by the IPM questionnaire. The affect variable may either be measured by autonomic responses or by decoding nonverbal behavior following Gottman, Markman and Notarius (1977). Whether affect is measured by autonomic indicators or nonverbal techniques, it is probably most efficient to collapse the measurement into the presence or absence of affect for the other in relation to each issue. In the system of orientation for one issue, affect may be present, but in relation to another issue, affect may be neutral or absent.

6.2 Information: The Selective Function

Information is measured by the selective function it performs. The amount of information in a message is measured by the change in the individual system of orientation. If individual A transmits a message to person B and, yet, person B's system of orientation remains in the same state; then no information has been communicated. This is not to say that a message has not been transmitted but only that no information has been received.

Information, then, means that there is a change of state in the individual system of orientation of the receiver. A change of state in a system of orientation is measured by a change in one or more of the three variables of the individual system. Since each of these three variables has only two values, the maximum number of changes at any one time is three. Imagine the case where affect is positive, one cognition is positive and the other negative. The maximum change is where affect becomes negative, the positive cognition becomes negative, and the negative cognition changes to positive. Thus, for each individual system of orientation, information can be measured as varying from no changes (0) to three changes. Information, in terms of bits, takes on a maximum value of three bits.

Empirically, a change of state is recorded when person A communicates to person B and, subsequently, person B communicates to A so that the B-to-A communication reveals changes in affect (nonverbal behavior) and cognition (IPM or CISS) from the previous time that B communicated to A on this issue. Since it is impossible to administer the IPM to measure cognitive changes in an ongoing interaction, the CISS (Gottman, Markman and Notarius, 1977) can be used to indicate cognitive changes from verbal behavior. Other content codes can be easily designed from the IPM to indicate shifts in cognitive elements from verbal behavior. This means that the information value of person A's message to person B is only known when person B transmits a message to person A. If it is known from previous interaction from person B to person A that person B is positively balanced, and there is no communication subsequent to a message from person A, then it can be assumed that no information was received. More generally, whenever there is no subsequent communication on an issue, it must be assumed that no information has been received. However, such a situation is most unlikely on even the most trivial issue over time.

6.3 Degree of Balance and Perceptual Impedance

Balance refers to the state where all of the signs are positive in both individual systems of orientation. Individual cognitive consistency, "balance" in terms of Heider (1958), is insufficient as an explanatory model simply because the minimum unit of analysis is the dyadic relationship. Cognitive issues are always in relation to another or others; they are always social. Even though an individual system of orientation is consistent, the goal state of the relationship explains the changes that two individuals go through as they seek to mutually adjust themselves so as to attain a positive and balanced relationship.

The degree of balance is a measure of the distance an individual system or a relationship is from complete positive balance. For an individual system of orientation, the degree of balance is measured by the number of sign changes necessary to achieve positive balance. Thus, the maximum number of sign changes for an individual system is three. For the individual, the degree of balance is zero for positive balance, and three for complete imbalance.

The same principles apply to the relationship system. Since there are two individual systems in the relationship, the maximum number of sign changes necessary to achieve positive balance in all systems is six. The minimum is, naturally, zero.

In the case of dyadic systems, there is little concern with comparing graphs with different numbers of vertices. All graphs in the dyadic system have three vertices. This is rather convenient, since the conventional formulas for degree of balance share as a weakness the lack of comparability of different-sized graphs. For the present purposes, however, the conventional formulas are not adequate since they consider balance as the positive product of the signs of a cycle. This type of formula is at odds with the definition of balance as a graph whose vertices are all positive. A simple formula for the degree of positive balance [+ b(G)] follows in Figure 6.1. In this measure, the degree of positive balance varies from one to zero. In the case of a triangular graph it only assumes four values; 1, 0.666, 0.333, and 0. Where the triangular graph represents an individual system of orientation, the degree of positive balance is interpreted as the proportion of positive consistency. In the product of the two individual systems, the degree of balance is interpreted as the proportion of understanding in the relationship.

$$+\,b(G) = \frac{+\,V(G)}{V = (G)}$$

where $+V(G)$ = the number of positive vertices in the graph; $V\ (G)$ = the total number of vertices in the graph

Figure 6.1. Degree of Positive Balance

The degree of positive balance [+ b(G)] is related to the degree of perceptual impedance in an individual system of orientation. As the individual system approaches a state of positive balance, the perceptual impedance rises. A state of complete positive balance has the highest perceptual impedance as well. Thus, perceptual impedance is measured directly by the degree of positive balance. When the degree of positive balance and perceptual impedance are zero, then the individual is open to, if not actively seeking, information. For example, it would be expected that, within a couple seeking marital therapy, at least one individual has a low level of perceptual impedance, since seeking therapy is seeking information.

In summary, then, conventional measures for the degree of balance are rejected since they rely on different conceptions of balance. A simple ratio formula for the degree of positive balance [+ b(G)] in a graph can be used to measure positive balance in either the individual systems or the relationship system. This measure also functions as a measure of perceptual impedance for the individual systems of orientation.

6.4 Time Intervals

The dyadic system changes over time. These changes are recorded by verbal and nonverbal indicators of the cognitive and affective elements. It is desirable that these changes occur at specified time intervals so that the state predictions of the Markov chain can be verified. For instance, if the time interval were known, a researcher could administer the IPM to ascertain the various starting states for the process, and then administer the instrument again at so many time intervals later, to find if the empirical distribution of states corresponds to the analytic distribution.

However, such a precise demarcation of time intervals is impossible. First of all, an issue is not constant for a couple but is confronted at one time, and then other issues intercede, and later the original issue will be confronted again. Even in a controlled setting such as a laboratory or counselling session, where a dyad is asked to discuss and confront one issue in their relationship, the time interval may not be constant. For example, in such controlled settings, the intervals, although not constant, might at least be identical to the communication exchanges. Thus it would be possible to count a communication from A to B as one unit of time, and an exchange from B to A as another unit. This is possible so long as the values of the system do not change within the unit of exchange. The change of value within one unit of communication, say A to B, is either due to exogenous disturbances or to continuing nonverbal transmissions from B while person A is communicating. For instance, person A may be saying that he thinks person B likes X and, as person A utters this statement, person B is shaking his head and frowning. No sooner does A conclude the statement than he must offer some retraction and change of state. Of course, sensitive coding should pick this interchange out of a series. The clue is the change of state during the conversation of person A. Thus, a simple identity between communication exchanges (especially verbal alone) and time intervals will not suffice.

In reference to the dyadic system, time intervals are not measured in minutes or hours, but rather in changes of state. The changes of state in the dyad represent units of time, and the Markov chain predicts the average number of these units in each state before absorption.

6.5 Aggregation of Issues

The discussion thus far has dealt with the dyadic system in relation to only one relationship issue at a time. The treatment of one issue in isolation may be relevant for controlled settings; however, for other settings it is inappropriate. This is because in natural settings an issue may be confronted at one time and then not returned to for a lengthy interval. This, of course, makes research on one issue difficult. Another reason that one issue research is inappropriate in a natural setting is that states of the dyad for one issue surely interact with states for other issues. For example, if there is negative affect in many of the issues, this affect will undoubtedly have some affect on other issues.

Laing, Phillipson and Lee (1966) selected the 60 issues of the IPM from an original list of 2,000 words and phrases. Redundancies were eliminated and some pretesting narrowed the issues to 84. These 84 were further reduced by the results of test-retest studies and item analyses to a final group of 60 issues. Laing, Phillipson and Lee (1966:51-52) divide these 60 issues into six categories: (1) interdependence and autonomy; (2) warm concern and support; (3) disparagement and disappointment; (4) contentions; (5) contradictions and confusion; and (6) extreme denial of autonomy.

These six categories may be used to aggregate the 60 issues. Since the IPM only measures cognitions, the average response to each category can be used to aggregate cognitions. Affect must be measured independently of the IPM; however, the six categories can be used in a natural setting to elicit communications so that affect may be ascertained. An even simpler method, though less reliable, is to assess affect for all issues (or general affect) from observations of the couple. Such observations would simply record the number of nonverbal communications containing positive and negative or neutral affect based on a coding scheme such as the one employed by Gottman, Markman and Notarius (1977), or a simplified version of the scheme used by Mehrabian (1972). Hence, affect for each issue and, as well, affect for the six categories of issues would not be measured. Only the general affect in the relationship would be measured.

The aggregation of issues, cognition and affect, allows for the study of dyadic states in relation to exogenous variables such as political and economic variables. The IPM is singularly unsuited to survey research due to its length. However, by using the six categories of issues, and selecting key items or issues to indicate the states coupled with interviewer observation of couples' interaction to tap affect, the study of the dyadic system can be pursued via survey research techniques.

Although the IPM and cautious coding of affect for each of the 60 issues may be used in controlled situations to research dyadic relations, it is too intractable a method to be applied in survey research. In such cases, the cognitive elements measured by the IPM may be aggregated into six categories. Another alternative is to use key items or issues in the six categories proposed by Laing, Phillipson and Lee (1966) to indicate the state of the system for that aggregation of issues. Affect is more easily measured by simplified observation schemes which can be coded by an interviewer as couples discuss designated key issues.

6.6 Closed and Open Systems

Undoubtedly, few relationships achieve complete positive balance on all or even most of the issues in a relationship. The model of interpersonal perception and communication is a model of a closed dyadic system. The dyadic system would work this way if exogenous variables can be controlled. The situations which allow sufficient control over exogenous variables are few; for instance, small-groups labs. However, the advantage of working with a closed model is that after an approximation of the dyad as a closed system is reached, then it is possible to consider exogenous variables and systems of variables to discover the effect these values have on the various dyadic states and the balancing process. Thus, a closed system model, in this view, is the logical antecedent to the development of an open system model.

An empirical relationship such as a marriage is not a closed or open system. To label it as one or the other is reification. Rather, it is more accurate to describe a relationship as operating *like* a closed or open system, depending on the interest and problem of the researcher. It is a tacit assumption that the closer the analogy is to the empirical situation, the greater will be the probability of verification (or iconicity in the language of information theory).

6.7 Conclusion

This chapter discusses six measurement issues which relate to the model presented in Chapter V. The issues of affect and cognition (6.1), information (6.2), degree of balance (6.3), and time intervals (6.4) are in part a preparation for the data presented in the following chapter. The discussion of the aggregation of issues (6.5) is aimed at facilitating survey research. And finally, the distinction between closed and open systems seeks to further clarify the model and its limited claims as well as its potential for further development.

CHAPTER VII

AN APPLICATION OF THE MODEL

The intention of this chapter is to apply the model to a set of data. This application of the model is different from hypothesis testing. Hypothesis testing basically seeks to examine a proposition empirically and to either reject it or fail to reject it. There has been much work on testing Markov models which is germane to the future evaluation of the model. These techniques require aggregate data to model the stochastic process. The techniques by which estimates of transition probabilities may be computed are considered by Anderson (1955); Anderson and Goodman (1957); Lee, Judge and Zelner (1970); and Burton and Spilerman (1976), to mention but a few. However, for the present purpose the model is examined to highlight its various aspects and raise certain general questions with the aid of case studies. Such an initial examination can be viewed as the precursor to the more full-blown testing of the model. This application of the model seeks to examine three areas of concern in the model, and to develop a broad range of information concerning the model.

First, the application seeks to demonstrate that the model can be used empirically. That is, the application ties the model to corresponding empirical measurements. Chapter VI examined some of the correspondences between graphs of the dyad and concepts such as affect and cognition. In order to operationalize the model, these concepts must be related to corresponding measurements. Thus, in part, the application of the model entails the details regarding empirical measurement.

Secondly, the application of the model functions to supply information regarding the usefulness of the model as an interpretive device.

A model of dyadic communication and interpersonal perception should aid in the understanding of what happens when two people interact with one another. That is, this particular model should serve a hermeneutic function in terms of a set of empirical data.

Thirdly, an application of the model indicates the "fit" between the data and the model. If the model is somewhat analogous to the dimensions of the interacting dyad being tapped by the measurements, then the estimate of the closeness of the analogy is the "fit" between the model and the data. In this sense, the "fit" is the discrepancy between the outcomes expected by the model and the empirically observed outcomes.

The application of the model, then, serves three purposes. It demonstrates that the model can be operationalized. Further, the model interprets the data so that understanding is enhanced, and the application exhibits the degree of "fit" between the model and a particular data set. These three functions are aimed at increasing the understanding and clarity of the model more than they are aimed at explaining the data. Rather, the application of the model serves the overall purpose of further illuminating and clarifying the model. The application may suggest revisions and alterations in the model which may increase the model's utility. The application, however, is different from hypotheses testing and disconfirmation.

The model is applied to two case studies. One of the case studies is drawn from a play by Neil Simon. The other case study is of a married couple interacting in a controlled setting. Case studies are especially well-suited to illustrate the application of the model. Although the model is stochastic and, hence, must be tested for goodness of fit on a large sample, the case study technique can point out certain anomalies and provide a demonstration of the way in which the model may be tested. Furthermore, a case study application aids in the initial assessment of the model's usefulness as a descriptive topographical technique even though it does not allow a clear assessment of the goodness of fit of the model.

7.1 Application of the Model to a Play

Although literary examples may be used by sociologists in the classroom, literature is not often used as a data source. This may be partly due to the reactions of practitioners of a science in its formative stages, as Coser (1963) suggests. Another reason, undoubtedly, has been the methodological concern with generalizing a characteristic to a population. However, when the research concern is the clarification of a conceptual model, literature may contribute to the refinement of concepts and relations in much the same way in which other types of data would contribute. As Clear, *et al.* (1976:ix) point out

> Fiction and drama are tested means of examining human needs for love and family relationships. Some of the greatest novels and plays center around these relationships. In *Madame Bovary*, Gustave Flaubert pictures an incurably romantic woman who tragically refuses to accept the realistic limitations of marriage. In *Othello*, William Shakespeare, traces the deterioration of a marriage in which one of the partners is constantly suspicious and jealous. D. H. Lawrence's *Sons and Lovers* describes a young man who cannot move beyond his emotional tie to his mother and is therefore unable to fall in love or marry.

These are but a few examples of works germane to sociological concepts in general and the model of dyadic communication and interpersonal perception in particular.

The application of formal models to literature has received the attention of a few scholars. Harary (1963) analyzed an opera using graph theoretical structures. Stanton (1967) applies a similar graph theoretic approach to Shakespeare's *A Midsummer Night's Dream.* He reports that the degree of balance falls from Act I to Act II but then Act III becomes perfectly balanced. Harary (1966) performs a similar study on the play *A Severed Head*. Watzlawick, Beavin and Jackson (1967) attempt to interpret the Albee play *Who's Afraid of Virginia Woolfe?* using concepts from communications theory. However, their effort is probably not the systematic application that Taylor (1970) has in mind.

These applications of models to literature all suffer from the same problem. This is that these authors rely on an intuitive understanding of what is happening in the play. For example, Stanton (1967) traces who-loves-whom in graph theoretical structures but the judgment that an act or statement by a character means that character loves or hates another character is based on Stanton's understanding of the play. Undoubtedly, in the analysis of literature, there will always be some freedom in terms of interpretation. However, as in all scientific data collection, the method of measurement should not be dependent on the insight of one investigator. Rather, the measurements should be amenable to replication by any investigator. If the measurements are systematic, then a play or novel yields data in much the same way that any other empirical social phenomenon does. This is to say that, in work such as that conducted by Stanton, there should be clearly-defined criteria for the decision as to whether a character loves or hates another character. These criteria should be applicable to the dialog or stage directions in the play so that they may be objectively used by any investigator. A reliance on understanding may be acceptable for a literary critic; however, it fails to meet the standards of replication required in a scientific approach. This argument implies that a model must be operationalized in such a way that a series of measurements can be taken from the play.

Thus far, applications of models have been concerned with the interpretive function of the model. The operationalization of the model has not received sufficient attention and, hence, the "data" have tended to be nonsystematic. Since the models that have been applied have not generated a set of expected theoretical values, the assessment of the model's "fit" has not been possible.

In the case of the model of interpersonal perception and communication in the dyad, the measurement of cognition and affect can be ascertained from the verbal dialog and nonverbal (stage directions) behavior of a play. Hence, for this model a systematic set of data may be collected from a play. Interpretation of the play would follow the conceptual and analytic distinctions implied by the graph-theoretic approach to balance. Furthermore, the expected distribution of dyadic states, and verbal and nonverbal behavior, supplies the expected theoretical values necessary to gain some indication of the "fit" of the model to the observed data.

In conclusion, then, literary sources may function as data sources for some degree of refinement and clarification of the model. By applying the model to literary data, it is possible to illustrate one way in which the model is operationalized. The interpretive function of the model can be demonstrated by mapping the dyad through sequences of interaction. And some indication of "fit" can be gathered by the discrepancy between expected and observed values.

7.2 Methods

The selection of a literary work to be used as a data source followed several criteria. Since it would be an aid to coding both verbal and nonverbal behavior, it was decided that a play would be used. The stage directions in a play allow coding of nonverbal behavior and the dialog supplies the verbal behavior. The criteria for selecting a play from the myriad in English literature were several. First, the play must contain an extensive dyadic relationship. Since the model is of a dyadic relationship, the play should contain as few interactions with external characters to the dyad as possible. Furthermore, the play should be written in common contemporary language to facilitate the identification of issues. Obviously, plays from other cultures and time periods were excluded.

A play which appeared to meet most of the criteria is Neil Simon's *Plaza Suite* (1969). *Plaza Suite* is actually divided into three separate plays. Each of the three takes place in the same suite in the Plaza Hotel. The first of the three, the "Visitor from Mamaroneck," is used as the data source, since it is mainly the interaction of a married couple with few interruptions from other characters. The other two plays within *Plaza Suite* were rejected on the grounds that one did not portray an on-going relationship but was a seduction, and the other contained too many outside characters interfering with the dyadic interaction.

Nonverbal behavior is taken from the stage directions in the play. The stage directions are the directions of the playwright as to the non-verbal behavior that he deems essential to the play. Undoubtedly, an actor might add idiosyncratic flourishes to the basic behavior described in the stage directions. And, as well, any director might choose to ignore or overemphasize certain stage directions based on his own interpretation of the play. However, the stage directions taken directly from the play are the playwright's directions for nonverbal behavior in the play.

The nonverbal behavior described in the stage directions is not always clear. There is no apparent resolution to these problems of interpretation in the present study other than to rely on the context of the play for resolution of such interpretive questions. Thus, in the last analysis, there are probably several possible data sets which could be derived from this play: Each data set would represent a different interpretation of the play. The data set used herein represents one such interpretation and is used to illustrate the model of interpersonal perception and communication.

Although the data gathered from the play represent only one possible data set, that is not to imply that some attempt at systematic data collection is not made. Rather, both the verbal dialog of the play and the nonverbal stage directions are coded. The nonverbal stage directions are scored following the coding system developed by Gottman, Markman and Notarius (1977). Much of this coding system was developed by Mehrabian (1972), but Gottman and his associates have refined the system and facilitated the scoring process.

The stage directions stand as a proxy for the nonverbal behavior. Nonverbal behavior--according to the model of interpersonal perception and communication, as well as Gottman, Markman and Notarius (1977)--reveals affect. The stage directions seldom yielded facial expressions or voice quality so these were rarely-used codes. Body movements, and sometimes eye contact, were more frequently encountered in the stage directions. The coding system can be illustrated by the use of an example. In the play, the stage directions might direct that the husband move away from the wife. According to both Mehrabian (1972) and Gottman, Markman and Notarius (1977), an increase in physical distance between people is an expression of negative affect. Since the husband is moving away, his affect for the wife is scored as negative. Although there may be times when this movement does not indicate negative affect, this coding process is tempered by a sensitivity to the context.

The coding scheme developed by Mehrabian (1972, and Gottman, Markman and Notarius (1977) is an attempt to systematize and understand the meaning of nonverbal acts. They do not claim, nor is it the claim of this study, that this coding procedure is without measurement error and misclassification. Rather, the coding scheme used here is the most complete and adequate system available to date.

Verbal content is supplied by the dialog in the play. The verbal content indicates the value, positive or negative, of the individual's cognition about an issue or about the other's attitude toward an issue. The issues discussed in the play are identified by the condition where two communicators use the same subject in their dialog. This is often difficult to assess. For example, in the scenes in which the couple discuss the husband's affair, the subject switches to the person with whom the husband is having the affair. For the sake of accuracy, this is considered a different subject though some might consider it the same. In general, the rule is followed that any literal change in subject is a new issue regardless of the possible overlap. Undoubtedly, in a conversation issues are associated; however, the model treats issues as discrete, and the literal identification of issues conforms to this treatment.

The positive or negative value of the husband's cognition about an issue is indicated by the husband's statements about the issue in the dialog. For instance, the first issue in the play is Sam's capped teeth. He has just returned from the dentist. He tells his wife that "These don't stain, you know. A hundred years from now when I'm dead and buried, they'll be the same color" (Simon, 1969:10). This statement indicates a positive cognition about his teeth. Sam's wife states that his new teeth will look very nice with a blue shirt and, hence, also has a positive cognition regarding Sam's teeth.

The person's cognition about an issue is easily tapped in the dialog. However, the person's perception of the other's cognition about an issue is more difficult. It is assumed that communication is sufficiently accurate that one person's statement of an attitude or cognition is registered by the other unless otherwise indicated. If there is an indication that there is a disagreement between the husband's cognition about an issue and the wife's cognition about her husband's attitude about the issue, and, then, the husband changes; then, the wife's cognition is treated as not changing unless indicated by a verbal statement. Of course, this treatment makes intuitive sense because then the husband's cognition about the issue, and the wife's cognition about her husband's attitude, would be in agreement.

As an example of the coding process examine the passage below.

Karen: Sam, do you remember this room? (Moving to him)

Sam: (Still examining his teeth) Well, two more caps and I'm through. (He turns, baring his teeth at her) What do you think?

Karen: (Puts her hands in front of her eyes to shield the glare) Ooh, dazzling!

Sam: You don't think they're too white, do you? (Turns and looks in the mirror again) Do they look too white to you?

Karen: No, no. Perfect. Very nice with the blue shirt.

Sam: (Still looking) These don't stain, you know. A hundred years from now when I'm dead and buried, they'll be the same color.

Karen: Oh, good. You'll look wonderful. You don't remember this room, do you?

In this scene the affect for the husband is scored as negative since his facial expression is "bared teeth," and he consistently avoids eye-to-eye contact in favor of the mirror. The wife's affect is scored as positive since she moves to her husband, decreasing physical distance. The stage directions where the wife is instructed to put her hands in front of her eyes to shield the glare of Sam's teeth present a somewhat ambiguous coding. In a strictly literal sense, the hands in front of the face cut off eye contact; however, the purpose of this seems friendly joking. Since no other cues seemed negative in this scene, it was decided that the wife's affect is predominantly positive.

The verbal coding of this passage is that Sam likes his teeth. However, he asks Karen if she likes his teeth. She says yes in several ways so that we assume Sam knows Karen likes his teeth. Karen also realizes that Sam likes his teeth inordinately.

This brief example serves to illustrate the manner in which both affect and cognition are coded in the play. At some points in the coding ambiguities were encountered and a coding decision made on the basis of the context of the play. However, these ambiguities were infrequent and most of the coding, both cognitive and affective, was straightforward. It is important to realize the limitations of the coding technique. The coding technique seeks to reduce affect to either a positive or negative value. This two-valued approach means that much of the variation within negative or positive affect is overlooked. Furthermore, although most of the time the coding system seems appropriate, it can sometimes misclassify nonverbal behavior. For example, moving to someone is coded as positive affect. However, in numerous situations this could mean aggression, dominance, etc., which should be coded as negative. One of the major limitations of the data from the play is that they don't allow for a constant monitoring of nonverbal behavior like the videotape of marital interaction does. The stage directions restrict the reading of nonverbal affect as it would occur in an enacted play. For this reason an attempt has been made to temper the application of the coding system with a sensitivity to the context of the act. In this way an act like Karen's hands in front of her face, which is somewhat ambiguous, may be more properly coded. This is not such a problem in the videotaped interaction, since independent readings on affect are taken using more than one measure. Due to the many limitations of these types of data, the results can only be viewed as one possible interpretation of the play. This interpretation attempts to be as consistent as possible by using the Gottman, Markman and Notarius (1977) coding scheme as a systematic way of scoring both nonverbal and verbal behavior.

7.3 Data

The "Visitor from Mamaroneck" begins with the entrance of a bellhop and Karen Nash into suite 719 of the Plaza Hotel. Karen is 48 years old and does not attempt to hide her age. She asks the bellhop whether she is actually in suite 719 and if any room number changes have been made. In addition, she places an order for hors d'oeuvres and champagne with room service. This brief interlude sets the stage for the entrance of Karen's husband, Sam Nash.

When Sam enters, he is angry that he has spent such a long time with his dentist getting his teeth capped. He is described as having just turned 50 and making every effort to conceal his age.

The interaction between Sam and Karen covers a range of issues running from his teeth to whether or not this is the suite in which the couple spent their wedding night. Karen believes this day to be their wedding anniversary but Sam assures her that it is the next day. The reason for them being in the hotel is that their house in Mamaroneck is being painted.

After a series of issues is discussed, the dyadic interaction is broken by the visit of Sam's secretary. This interlude covers about five pages of dialog, in which Sam and the secretary discuss business and returning to the office to work, while Karen offers coffee and small talk.

After the secretary departs, Sam shaves and puts on cologne. This raises the question from Karen as to the possibility that Sam is having an affair with his secretary. After considerable discussion, Sam admits he is having an affair and offers to reconcile with Karen. Karen accepts, but then Sam departs to the office to work with his secretary, despite the pleas from Karen that he stay with her. The bellhop brings the champagne just as Sam is leaving, and asks if Sam is coming back because he has brought two glasses. Karen ends the play by saying ". . . Funny you should ask that." Thus, the audience is left on a questioning note as the play concludes.

From the stage directions and dialog, 42 dyadic state structures are found over 22 issues. These state structures are presented in Table 7.1 as they sequentially appear in the play. The issues discussed by the couple in the play are presented as Table 7.2.

Tables 7.1 and 7.2 provide the necessary reference material for

Table 7.1. Dyadic State Structures in "Visitor from Mamaroneck"

Case	Issue	Husband			Wife			Relationship			State Structure
		H-X	W-X	H-W	H-X	W-X	H-W	H-X	W-X	H-W	
1	1	+	+	-	+	+	+	+	+	-	I · B = I
2	2	-	+	-	+	+	+	-	+	-	B · B = B
3	3	-	+	-	+	+	+	-	+	-	B · B = B
4	3	-	+	-	-	-	+	+	-	-	B · B = B
5	4	+	-	+	+	-	-	+	+	-	I · B = I
6	4	+	-	-	+	+	+	+	-	-	B · B = B
7	5	-	+	-	-	+	+	+	+	-	B · I = I
8	5	+	+	+	+	+	+	+	+	+	+B · +B = +B
9	5	-	+	-	-	+	+	+	+	-	B · I = I
10	6	-	+	-	-	+	+	+	+	-	B · I = I
11	7	+	-	-	+	-	+	+	+	-	B · I = I
12	8	-	-	-	-	+	+	+	-	-	I · I = B
13	8	-	-	-	-	+	-	+	-	+	I · B = I
14	9	+	+	-	+	+	-	+	+	+	I · I = B
15	10	+	+	+	-	+	-	-	+	-	B · B = B
16	11	+	-	+	-	+	-	-	-	-	I · B = I
17	10	-	+	+	-	+	-	+	+	-	I · B = I
18	10	+	+	-	+	-	-	+	-	+	I · B = I
19	10	+	+	+	+	-	-	+	-	-	B · B = B
20	12	+	+	+	+	+	+	+	+	+	+B · +B = +B
21	13	-	+	+	-	+	+	+	+	+	I · I = B
22	14	-	-	-	-	+	+	+	-	-	I · I = B
23	15	-	+	-	-	+	+	+	+	-	B · I = I
24	15	-	+	-	-	-	+	+	-	-	B · B = B
25	16	-	+	+	-	+	+	+	+	+	I · I = B
26	16	-	+	-	-	+	+	+	+	-	B · I = I
27	17	-	+	-	-	+	-	+	+	+	B · B = B
28	17	-	+	-	-	+	+	+	+	-	B · I = I
29	17	-	-	-	-	-	+	+	+	-	I · B = I
30	18	+	+	-	+	+	-	+	+	+	I · I = B
31	19	-	+	+	+	+	-	-	+	-	I · I = B
32	19	-	+	-	+	+	-	-	+	+	B · I = I
33	17	+	+	+	+	+	-	+	+	-	B · I = I
34	17	+	+	-	+	+	+	+	+	-	I · B = I
35	17	+	+	-	+	+	-	+	+	+	I · I = B
36	20	+	-	+	+	-	-	+	+	-	I · B = I
37	20	+	-	-	+	-	-	+	+	+	B · B = B
38	21	-	-	+	-	+	+	-	-	-	B · B = B
39	21	-	+	-	-	+	+	+	+	-	B · I = I
40	22	+	-	+	+	-	-	+	+	-	I · B = I
41	22	-	+	+	-	+	-	+	+	-	I · B = I
42	22	+	-	-	+	-	-	+	+	+	B · B = B

Case refers to sample point. Issue refers to issue discussed.
W-X H-X refers to husband's or wife's view of issue.
H-W refers to affect between husband and wife.

Table 7.2. Issues Discussed in "Visitor from Mamaroneck"

1. Sam's teeth
2. Lipstick
3. Length of marriage (24 years)
4. Her age (48 years of age)
5. Karen putting in eyedrops
6. Painting house
7. Pajamas
8. His flabby self
9. Not fighting
10. Suite 719
11. Color of room
12. Lousy couple
13. Going to movie
14. She wants champagne
15. Telling waiter problems
16. Sam accepting age
17. Affair
18. Not a happy couple
19. He wanting out
20. Continuing discussion

Forgiving Sam

Miss McCormack

the interpretation of the play and the analysis of the model.

7.4 Results: Interpretation

The "Visitor from Mamaroneck" presents a classic scene of marital infidelity and disruption. The aging husband seeks out the affection of his youthful secretary to reinforce his virility. Despite the presence of some exogenous variables, the play can still be interpreted by the model. It is assumed that the issue of the affair with Miss McCormack does not *ipso facto* imply marital breakdown.

One way of analyzing this dyadic interaction is to use measures summarizing the interaction. One such measure is the degree of positive balance [b(G)] for each of the three triangular graphs in the dyadic state structure, i.e., the husband's system of orientation, the wife's system of orientation and the relationship. The degree of balance for each of these three groups of graphs over the entire play is summarized in Table 7.3. Over the entire play, 42 states, the husband's degree of positive balance is 0.476. The wife's degree of balance is 0.58 and the relationship is 0.63. A positive degree of balance measure varies from zero to one. Zero means that all the signs in the graphs are negative whereas a [b(G)] score of one implies that all the signs of the graphs are positive. Hence, a [b(G)] score of 0.5 indicates that there are as many negative signs as positive signs in the graphs. Referring to Table 7.3, it becomes clear that over the entire play it is difficult to characterize the graphs of the husband or wife as either exceptionally negative or positive since their [b(G)] scores do not depart too much from the [b(G)] of 0.5. The relationship over the entire play is in the positive direction.

One might suspect that the degree of balance would change

Table 7.3. The Degree of Balance for the Husband's System of Orientation, the Wife's System of Orientation and the Relationship Over the Entire Play and for the Last Sixteen Issues in the Play

	Husband	Wife	Relationship
Entire Play (42 states)	0.476	0.58	0.63
Last 16 issues	0.48	0.52	0.71

significantly when the issue of the affair arises. Using only the last 16 issues; that is, from the introduction of the affair to the conclusion of the play; there is no noticeable change in the degree of balance of the husband (0.48) or wife (0.52). In fact, the [b(G)] of the relationship increases from 0.63 to 0.71. This anomaly in the [b(G)] is exemplified by the last state structure of the play. This state structure reveals that, although the husband is walking out, both of them understand that they disagree and that there is negative affect.

The question arises, then, that if the degree of balance does not change throughout the play, and if in the last scene the couple achieve some understanding, then how can their separation be explained? The key does not lie in the meanings of the issues as can be demonstrated by the homogeneity of the degree of balance over the various issues. Rather, the key to answering this question has been previously suggested by Gottman, Markman and Notarius (1977). Gottman and his associates report that affect scores discriminate disturbed from nondisturbed couples with greater accuracy than do scores on cognitions.

An examination of the proportion of positive affect ($\frac{+\text{ affect}}{\text{total affect}}$) in the play further supports the findings of Gottman, Markman and Notarius (1977). The highest proportion of affect is for the wife, about

0.51. This proportion would be expected if affect is distributed randomly and, hence, is neither high nor low. The husband's proportion of positive affect is only 0.37. This means that in 63% of the state structures the husband is expressing negative affect. The affectual agreement' $\left(\frac{\text{+ affect relationship}}{\text{total relationship affect}}\right)$ as represented in the relationship is only positive 30% of the time. This implies that in 70% of the state structures the direction of the husband's affect is different from that of the wife's. Thus, an examination of affect throughout the play reveals that there is high negativity from the husband and that, in only 30% of the state structures, the direction of affect is the same. This difference in affectual direction is somewhat akin to the notion of rejection. That is, whenever one person feels positive towards the other, the other feels negative toward them, and vice versa.

Thus far, affect scores suggest, following Gottman, Markman and notarius (1977), that the dyadic breakdown in the play is due to the couple's affectual responses. On further examination, it is possible to demonstrate that the dyadic dissolution is, in fact, due to the wife's change in affectual response. With the introduction of the issue of the affair (18), the wife's affectual response drops from the overall proportion of positive affect of 0.51 to 0.25. The proporation of the positive affect of the husband and relationship does not vary significantly in these last 16 states; 0.37 to 0.375 and 0.30 to 0.375, respectively. In the 16 states immediately previous to the issue of the affair, the wife's proportion of positive affect is 0.56. The wife's proportion of positive affect over all 26 state structures previous to the introduction of the issue of the affair is a rather high 0.69. This implies that, although the introduction of the affair may well have accelerated the wife's negativity toward her husband, she was already involved in the process of becoming more negative.

To continue this particular interpretation, the idea that the marital dyad is a closed system is instructive. According to the interpretation argued thus far, the husband and relationship had attained values which showed some degree of stability in terms of affect. The wife, in the language of exchange, was giving more positive affect than she was receiving. The systems way of viewing this is that the relationship had achieved a homeostatic value of about 0.30 affectual agreement. Whenever the wife would be positive, the husband would respond negatively, and vice versa. Hence, the wife might be viewed as wasting energy, since the system is going to remain around this homeostatic value no matter what she does. Furthermore, the wife might have been progressing slowly toward this homeostatic value in the play since her positive affect changes monotonically in this direction, i.e., 0.69 to 0.56 to 0.25. One can only speculate that the wife's progression might have been accelerated by the affair. Perhaps, if Neil Simon were to write a longer play about this couple, the wife, then, would have still eventually reached an affectual value of about 30% positivity even without the impetus of the affair. However, this is certainly a moot point. It does, however, highlight the systems perspective. That is, the interpretation that the play contains a sequence of dyadic state structures progressing toward a state of affectual equilibrium.

Interestingly enough, the cognitive states do not show much variation over various issues. Or, to put this another way, the cognitive elements are distributed in about the same pattern throughout the play. In fact, the affectual elements for the husband's system of orientation and the relationship are distributed in the same pattern throughout the play. It is the wife's affectual response that varies significantly in the course of the play, while her cognitive elements remain in the same pattern. This does not imply that in all relationships the cognitive elements are not essential for explaining dyadic interaction. Even Gottman, Markman and Notarius (1977) report that cognitive variables do discriminate between disturbed and nondisturbed couples but that, as well, affectual values discriminate more accurately. This finding is supported by this case study of the "Visitor from Mamaroneck."

7.5 Results: Fit of the Model

Using data from a literary source such as *Plaza Suite* does allow some assessment as to how well the data fit the model. However, in the case of literary data, the fit of the model reveals the degree to which the author might have viewed relationships as following this model. It is supposed, of course, that the model, and the author's view of relationships, as portrayed in the play, are independent of one another.

An analysis of fit is designed to demonstrate the degree to which the data approximate the expectations of the model. For the present purposes, this analysis of fit seeks mainly to demonstrate the articulation of the model with a data set. In this sense, the concern focuses on the expectations of the model and the type of data required to assess the fit between the two. Hence, this section aims to further clarify the model by illustrating the way in which goodness of fit between the data and model might be assessed.

The first question to be asked in regard to fit is "Do the observed state structures conform to the distribution of state structures expected from the model?" In order to answer this question, examine the information in Table 7.4. Note that Table 7.4 gives the distribution of observed values from the play and the expected distribution of the 42 states from the play.

Table 7.4. Observed and Expected Distributions of State Structures*

State Structure	Frequency		Proportion	
	Observed	Expected	Observed	Expected
+B · +B = +B	2	2.625	0.0476	0.0625
B · B = B	11	7.875	0.2619	0.1875
I · I = B	9	7.875	0.1666	0.1875
I · B = I	11	10.5	0.2619	0.25
B · I = I	10	10.5	0.2619	0.25
−I · −I = +B	0	2.625	0.0	0.0625

*χ^2 sig ≐ 0.50

Employing the familiar Chi square (χ^2) test for goodness of fit, it is found that the observed values would be expected to occur in sampling about 50% of the time. Although this result may appear convincing, in fact it is not totally. In the case of using Chi square as a goodness of fit measure, it must be remembered that the hypothesis being tested is actually the null hypothesis, Thus, in order to maximize the probability of rejecting the null hypothesis, the significance level should be fairly high. So, knowing that the values in the observed distribution would vary this much from the expected values about half the time, is not as impressive as it might seem if the substantive hypothesis is the one to be rejected. In the present case, it is about equally plausible that the observed values are or are not conforming (fitting) to the expected values from the model.

A second area in which the fit of the model may be evaluated is the transition between state structures. The transitions from time one (t_1) to time two (t_2) in the balancing process were hypothesized to follow the principle of least costs. This implies that, as the dyad struggles for positive balance, it attempts to make the fewest number of changes possible. According to the axiom of least costs, then, it is expected that state structure transitions in the data should be rank ordered so that the fewest sign changes from state to state are the most frequent, and the greatest number of sign changes are the least frequent. Table 7.5 gives the frequencies of each sign change in the data.

Table 7.5. Sign Changes from t_1 to t_2 on the Same Issue

Number of Signs Changed	Frequency	Percent (%)
1	9	42.8
2	3	14.3
3	4	19.0
4	2	09.5
5	1	04.7
6	2	09.5
	21	99.8

In Table 7.5, it is clear that the transitions follow some rough approximation to ordinality. One way to interpret this is that if transitions were equally-probable (i.e., maximum entropy) then each sign change would occur 3.5 times out of the 21 transitions. This means that the percentage difference for one sign change is about 26.2; a difference so large that it would not be expected to be due to chance. Thus, the expectations based on the least costs axiom appear to be reasonably approximated by the data.

An area related to the state structure transitions is the Markov model of the balancing process. In terms of the data, it is possible to ask "How well do the data fit the transition matrix of the Markov model?" Recall that the assumption behind the transition probabilities of the Markov model was that only one sign at a time would be changed. This assumption follows the constraints of the principle of least costs. Although it has been demonstrated that the data tend to follow this principle, there are only nine cases that should be modeled by the Markov chain. The distribution of these cases is given in Table 7.6, along with the model's expected transition probabilities. Since the number of cases in each row is so small, it is impossible to evaluate the empirical distribution's discrepancy from the expected distribution. However, the form of the transitions in the data conforms to that expected by the model. This is to say that there are no cases which are misclassified according to the model. For instance, it is empirically possible to have a transition from state structure +B · +B = +B to B · I = I with only one sign change. The fact that no such cases of misclassification occur is somewhat encouraging. So, although it is impossible to state the degree of fit in this case, it is, nonetheless, possible to say that at least the empirical data fail to contradict the expectations of the model.

Another way of examining the balancing process, as modelled by the Markov chain, is to ignore the assumption of one sign change at a time and see if the matrix of all transitions for the same issues is similar to the expected transition frequencies. Tables 7.7 and 7.8 present this information.

Table 7.6.* Transition Matrix for Data Changing Only One Sign at a Time

	+B·+B=+B	B·I=I	I·B=I	I·I=B	B·B=B	-I·-I=+B
+B · +B = +B	(1)					
B · I = I	(.09)			(.454)	1 (.454)	
I · B = I	(.09)			1 (.454)	2 (.454)	
I · I = B		2 (.5)	1 (.5)			
B · B = B		1 (.5)	1 (.5)			
-I · -I = +B		(.5)	(.5)			

*Parentheses contain expected probabilities.

Table 7.7. Transition Matrix for Data on the Same Issue

	+B·+B=+B	B·I=I	I·B=I	I·I=B	B·B=B	-I·-I=+B
+B · +B = +B		1				
B · I = I	1		3		1	
I · B = I			2	1	4	
I · I = B		3	1			
B · B = B		2	1		1	
-I · -I - +B						

Table 7.8. Expected Transition Matrix for Data on the Same Issue

	+B·+B=+B	B·I=I	I·B=I	I·I=B	B·B=B	-I·-I=+B
+B · +B = +B	1					
B · I = I	0.45			2.27	2.27	
I · B = I	0.73			3.17	3.17	
I · I = B		2	2			
B · B = B		2	2			
-I · -I = +B		0	0			

Table 7.7 and 7.8 obviously do not have sufficiently large cell frequencies to justify the use of formal goodness of fit tests such as Chi square. However, considerable insight into the fit of these two matrices can be gained by inspection of the cases of misclassification. There are seven cases of misclassification in Table 7.7 according to the expectations in Table 7.8. This means that the data are misclassified in 33% of the cases. However, all of these cases of misclassification are due to the violation of the assumption of one sign change at a time.

The most startling anomaly in the data is the transition from the absorbing state of complete positive balance to one of imbalance (i.e., +B · +B = +B to B · I = I). Even though this transition requires three sign changes, nonetheless, according to the model it should not occur. This anomaly threatens the assumption that the balancing process acts like an absorbing Markov chain.

An explanation of this outcome is possible by a careful consideration of the play. There are actually two places in the play where complete positive balance is achieved. One is on the issue (12) of how "lousy" a couple Sam and Karen are. The other time complete positive balance is achieved is in relation to the issue of putting in Sam's eyedrops (5). After both of these times, there is an exchange of physical affection. In fact, when positive balance is achieved on the eyedrops, the couple kiss, the only occurrence in the play. The second time they achieve balance, the couple hug. The positive balance, in regard to the issue of the couple being "lousy," acts as an absorbing state. In other words, the issue does not occur again. However, the positive balance in regard to the issue of the eyedrops does occur again but as imbalance rather than the predicted positive balance. The explanation for this is an exogenous variable. After the couple have kissed, and Karen is putting in the eyedrops, she accidentally stabs Sam in the Eye. This perturbs Sam and destroys the positive balance. This can be viewed as an exogenous variable like any other category of accident such as earthquakes or car accidents. In the play, this serves the function of demonstrating that Sam and Karen can be warm and loving but, then, a *deus ex machina* effect is needed to remove them from this state. Hence, the transition out of positive balance is a result of exogenous or uncontrolled variables not included in the closed dyadic system. As previously stated, the dyad moves into and remains in complete positive balance until acted upon by an exogenous variable.

Another area in which the model can be assessed as to fit, is the area of uncertainty for each state structure. Uncertainty was partitioned into those structures with only negative affect; those with only negative cognition; and, those with both negative cognition and affect. Tables 7.9 and 7.10 show the observed and expected values in percent for the distribution of uncertainty for each state structure. Due to the small number of cases, and the large number of cells with no frequency observed, it is not advisable to perform the Chi square test. However, an alternative technique is possible. Since it is desirable to maximize the chances of rejecting that there is no difference between the expected and observed distributions, the cell in each row, which is maximally different than the corresponding cell in the other distribution, can be examined by means of a single sample difference of proportions test. The cells which have no entry are excluded from analysis, and only those with entries which maximize the difference between expected and observed proportions are analyzed. Hence, only one cell in each row is analyzed.

Table 7.9. Percentage Distribution for Observed Uncertainty in Each State Structure

State Structure	Negative Affect	Negative Cognition	Negative Affect and Cognition	Total Cases
+B · +B = +B	0	0	0	2
B · I = I	10% (1)	0	90% (9)	10
I · B = I	18% (2)	0	81.8% (9)	11
B · B = B	0	0	100% (11)	8
I · I = B	37.5% (3)	25% (2)	37.5% (3)	0
-I · -I = +B	0	0	0	

Table 7.10. Percentage Distribution for Expected Uncertainty in Each State Structure

State Structure	Negative Affect	Negative Cognition	Negative Affect and Cognition
+B · +B = +B	0	0	0
B · I = I	6.2%	12.5%	81.2%
I · B = I	6.2%	12.5%	81.2%
B · B = B	0	20.0%	80.0%
I · I = B	6.6%	26.5%	66.6%
-I · -I = +B	0	0	100.0%

For the state structure B · I = I, it is found that the maximum difference is to be expected about 74% of the time. As well, for state structure B · B = B, the difference is to be expected about 46% of the time. However, the other two state structures, I · B = I and I · I = B, are expected only about 2% and 0.001% of the time. These values cast some doubt as to the adequacy of the fit between the expected and observed matrices. Furthermore, the fact that negative cognition alone does not occur at all in three out of the four categories expected, certainly reinforces doubts concerning the fit.

This lack of fit points out that Neil Simon, the author of the play, may not view communication in the same way as suggested by the model. After all, if Simon had written the play using the model, then the observed and expected values would be very close. Using the measurements developed for the model, which may be irrelevant to Simon's purposes, it is possible to pinpoint some of the discrepancies between the model and the data from the play. The data from the play show more negative affect occurring alone than the model would suggest. As well, the data reveal a greater amount of negative cognition occurring alone than expected by the model. Also, there is more negative affect and negative cognition occurring jointly than the model would predict. The discrepancy between the data from the play and the expected values of the model gives some rough estimation of "fit." However, it must be cautioned that this "fit" is not between the play and the model but, rather, between the data collected from the play and the model.

In summary, then, the fit of the model with the observed data has been analyzed in terms of several distributions. Notable cases where the model fails to fit the observations are in the "same issue" transition matrix and the distribution of uncertainty. The lack of fit in the same issue transition matrix is obviously due to the violation of the assumption of one sign change at a time. Undoubtedly, if a playwright followed this model, the play would contain more silences and nonverbal behavior. This might not achieve the intensity desired by Neil Simon or the audience. The play does not include large numbers of exogenous variables and, hence, changes in the dyad must be kept rapid and in some cases unpredictable. The lack of fit of the empirical distribution of uncertainty is due to the trend of the wife toward the homeostatic value of affect for the system, and the author's need for complex state structures, in order to maintain the interests of the audience. Even with these considerations, the fit of the model in regard to the Markov chain and distribution of states is surprisingly close as is evidenced by Tables 7.4 and 7.6.

7.6 Conclusions

This chapter applies the model of dyadic communication and interpersonal perception to a set of data. The date are gleaned from the play *Plaza Suite* by Neil Simon; specifically that section of the play entitled the "Visitor from Mamaroneck." The application of the model demonstrates that the model is empirically operationalizable. The manner in which affect and cognition are measured is considered in the section on methods. The second purpose of this application is to exhibit the interpretive function of the model. The interpretation of the play using the model, discovered that the structure of the play is such that the character of the wife, Karen, changes her affect to match the affect value in the dyadic system. The cognitive values and the degree of balance remain in about the same pattern throughout the play and, hence, the interpretation is in terms of the changes in affect of the wife. Lastly, the application of the model entails the analysis of the fit between the model and the data. Although the data constrained the analysis of fit somewhat; nonetheless, there existed some degree of fit. The most notable exception is in the area of communication. Here, there were several disparities which may be explained by the structure of the play and the author's consideration of the audience. Regardless of anomalies, the overall purpose of the application of the model is achieved. That is, the model is demonstrated to be operational empirically, to serve an interpretive function, and to be subject to goodness of fit criteria.

7.7 Application of the Model to Husband-Wife Interaction in a Controlled Setting

This section applies the model of interpersonal perception and communication to a married couple interacting in a controlled setting. The purpose of this application is identical to the previous application to the play. That is, the application seeks to demonstrate the way in which the model may be operationalized. It also seeks to interpret the data, and it evaluates the fit of the model with the data set.

The differences between this application and the previous application to the play are that the controlled setting should exclude more exogenous variables than possible with the play and more detailed data collection is possible.

7.8 Methods

The design of this study facilitates the fitting of the model in that exogenous variables are minimized by a controlled setting. Furthermore, the couple is asked to discuss one issue drawn from the IPM until they reach an impasse or resolution. This technique is similar to the revealed differences technique used by others, and it maximizes the transitions between state structures for the same issue which the Markov chain models. During these discussions the couple was videotaped so that changes in behavior could be more carefully measured.

The measurement of behavioral affect follows that used by Gottman, Markman and Notarius (1977). Gottman's coding scheme (CISS) is employed rather than Mehrabian's scheme in this study for several reasons. Both coding schemes are very similar; however, unlike the play previously analyzed, the facial expressions of the respondents must now be coded. Mehrabian (1972) deals with these facial expressions by having a panel of judges assess facial expressions on a semantic differential scale. This is a rather cumbersome procedure and Gottman's (1977) work on coding facial expressions has developed a more precise way by which facial cues may be coded. Gottman's work was assisted by developments in the field that came after the work of Mehrabian (1972).

Gottman's coding scheme (CISS) deals with four areas of nonverbal behavior, i.e., face, voice, speech disturbances and body movements (see Appendix III). Following Mehrabian's suggestion, Gottman prioritizes the affect carried in each area. Hence, if the face is coded as carrying positive affect, then the coder is directed to not bother with voice, speech disturbances or body movements, since the face is judged to carry the predominant affectual message. However, if the face reveals no codable affect, then the vocal cues are examined. In turn, if the vocal cues reveal nothing, then the speech disturbances are examined for affect and, lastly, the body movements. In the present study, this prioritization of cues is employed following Gottman, but all cues are coded so that an assessment of consistency of nonverbal affect in all four areas can be made. This additional information allows the assessment of the consistency of the message on all four nonverbal channels. The Gottman technique seems to rely too heavily on just the facial cues, and excludes both supporting and contradicting cues such as body movement from his analysis. This is not done in the present study.

The verbal interaction of the couple is scored using a combination of the IPM (Appendix II) and two of the content codes from the CISS, i.e., agreement and disagreement (Appendix III). The IPM questionnaire technique is used to gain an indication of the cognitions at the beginning of the interaction. Furthermore, it is employed to reveal disagreements between the spouses on specific issues to them so that they may discuss the particular issue. Each issue of the IPM actually contains two statements. For instance, the issue "believe in" contains the statement "Husband believes in Wife"; the husband would respond that the statement is true for him but he might answer that his wife would say it is false. This means that for each statement there are two cognitive values for the husband and two for the wife.

An example might make this technique more clear. The starting state determined by the IPM questionnaire for the statement "Wife believes in Husband" is as indicated in Figure 7.1. Forty seconds into the discussion the wife says "I believe that you can do things but I don't have the same confidence in you that you do in me." In this statement she is indicating a change from believing in her husband to not believing in him, as is indicated in Figure 7.2. According to the CISS, this is a Type II disagreement and is of the form of a "*yes, but* . . ." type of statement.

Figure 7.1. Starting Cognitions "Wife Believes in Husband"

Figure 7.2. State for Cognitions after 40 Seconds

This type II disagreement is often encountered in the sessions yet it does not necessarily mean a change of sign or cognition. For example, in the fourth session the issue statement of "Wife is mean with Husband" is discussed. The questionnaire responses indicate that the husband believes that his wife is mean and he thinks that she knows she is mean. The wife, on the other hand, thinks that she is not mean and that her husband thinks she is not mean. Thus, the starting state structure is as in Figure 7.3. At one minute and five seconds the husband said

> I agree that you're definitely not making an effort to be mean to me. But I believe that you're aware and I feel that you're being mean to me because of your lack of consideration for my needs, for taking time for me and, uh, being very cutting at times when its not called for.

Again this is a Type II disagreement but does not reveal a change in the husband's system of orientation. He states that his wife is not making an effort to be mean *but* then says she is aware of her meanness. This simply supports or reiterates the starting state where he believes her to be mean and thinks that she knows she is mean. Thus, there is no change of state.

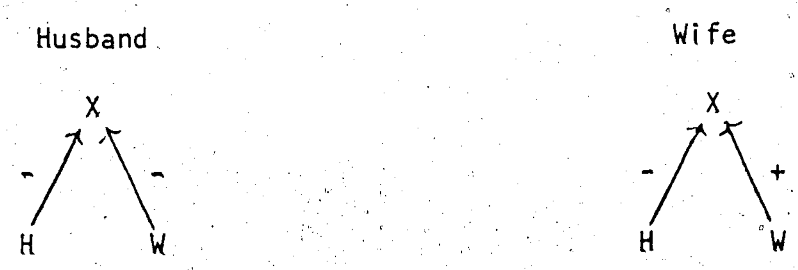

Figure 7.3. Starting Cognitions "Wife is Mean with Husband"

7.9 Procedures

A married couple was asked to fill out a brief questionnaire adapted from Laing, Phillipson and Lee's (1966) version of the IPM. The questionnaire contained 30 items randomly selected from the 60 items of the original IPM. A proportional number of questions was drawn from each of the six issue areas of the IPM (see Appendix II). This served two purposes: (1) it allowed the investigator to ascertain the starting state in terms of cognitions on an issue; and (2) it allowed the couple some familiarization time in the laboratory setting. The small-groups laboratory had previously been arranged so that it was as warm and comfortable as possible.

After the couple completed the questionnaire, they were asked to relax for a few minutes but not to discuss the areas covered in the questionnaire. Interaction was videotaped from this point to assure the investigator that no collusion regarding the questionnaire items occurred. At this point the investigator left the room to identify an area of disagreement from the IPM questionnaire.

The investigator returned to the experimental room and explained the disagreement. The couple were also shown the questionnaire responses. They were instructed to discuss the issue disagreement until it was either resolved or reached an impasse. At that point the couple was instructed to knock on a table and the investigator would give them the next issue.

At the end of approximately 40 minutes, six issues had been discussed. Some fatigue was noticeable in the last session so the study was concluded. The respondents were each paid $15. At this time the video equipment was shut down and the investigator spent a short time assuring the couple of anonymity and discussing briefly their feelings about the session.

The videotape of the six issue sessions was viewed several times by the investigator. This viewing suggested that some of the issue sessions were not as clear as might be desired. These sessions were discarded from analyses. The first session was discarded as an adjustment session since one of the participants seemed very nervous. Sessions three and five were both plagued by semantic problems where the couple did not understand the question or, when shown their responses, decided that they had misinterpreted the question and did not intend the answer. Session six was plagued by symptoms of fatigue and as well had the couple discussing an issue on which the spouses both agreed rather than disagreed. This was intentionally designed this way to examine the model's assumptions regarding the absorbing state; however, the forced response situation and fatigue both mitigated against a clear reading of the data.

Two issue sessions, two and four, were deemed suitable. These two sessions showed real disagreement rather than confusion over interpreting the questions. [From this experience it may well be that a less ambiguous instrument than the IPM should be developed. However, in initial pretesting, and in Laing, Phillipson and Lee, these problems did not arise. It might therefore be a function of either the particular situation in the laboratory or an idiosyncratic response of this particular couple.]

These two sessions (two and four) were coded and scored for affect. Unlike Gottman, Markman and Notarius (1977), who would only score voice if the facial cues revealed nothing, the present work scored all the nonverbal behavior. The coding of all the nonverbal data was in part necessitated by the quality of the video image and the fact that the one camera often only picked up half of the face. By using all the nonverbal codes, a greater reliability could be achieved in the coding of affect. The implication of this outcome is that future research should use a minimum of two cameras, separated by 90° with the face pointed so that the angle is bisected. As well, the use of all nonverbal material is recommended to increase reliability and monitor redundancy of affect. The face and body movements were scored from just the video part of the tape with no audio output. Voice and speech disturbances were coded from a separate audiotape with no visual output. Thus, these four areas have a certain degree of independence in the coding. As well, the cognitive or content coding was done by an analysis of a verbatim typed transcription of the audiotape.

The assessment of reliability is somewhat limited in that only one coder was used. This means that intercoder reliability cannot be ascertained. This is certainly a limitation of the data in that there are no assurances that the same data would be obtained by another, independent investigator. However, all coding was repeated so that there could be an assessment of intracoder reliability. The coder returned to recode an area such as facial cues only, after all other areas had been coded. This involved a considerable length of time between the first and subsequent codings. This was done in an attempt to insure as much as possible independence between codings. The intracoder reliability is reported in Table 7.11.

The assessment of the validity of the affectual coding can be partially assessed by the agreement between the audio dimension and the visual. The coding of voice and speech disruptions was taken from audio output only. The coding of facial cues and body movement was taken from the visual output only. Hence, the audio coding is independent of the visual coding. The percentage of agreement between the scores on the audio and visual coding gives some idea of the internal consistency of

Table 7.11. Intracoder Reliability Reported As the Percentage of Sign Agreement for Sessions Two and Four

			Second Session % Agreement	Fourth Session % Agreement
Nonverbal Affect				
	He	face	95.4	94.6
		voice	95.4	66.2
		speech disturbance	87.7	90.5
		body movement	72.3	79.7
	She	face	93.8	97.3
		voice	92.3	71.6
		speech disturbance	93.8	95.9
		body movement	86.2	87.3
Verbal Content				
	Husband believes in wife		57.2	
	Wife believes in husband		100.0	
	Husband mean with wife			100.0
	Wife mean with husband			83.3

the coding scheme. However, the interpretation of the percentage of agreement is confounded by the fact that probably most people do not communicate in a totally unambiguous manner. Therefore, some of the variation in agreement may actually be a result of the communication system of the couple rather than a reflection of the validity of the coding.

Table 7.12. Percentage Agreement of the Audio Coding (i.e., Voice and Speech Disturbances) with the Visual Coding (Face and Body Movement)

	Second Session % Agreement	Fourth Session % Agreement
Husband	81.5	67.6
Wife	66.3	79.8

7.10 Data

The data are presented in Tables 7.13, 7.14, 7.15, and 7.16. These tables are in a different format than the format which was used to represent the data from the play. This change is necessitated by the larger number of states in sessions two and four. The relationships graph is not drawn since it can be easily computed from the two individual states. The triangular graph on the left side of each cell represents the husband's and the right side represents the wife's system of orientation. Underneath the graphs in each cell is the symbolic or algebraic representation of the state structure for that five-second interval at which each session was sampled.

7.11 Results: Fit of the Model

The design of the present study allowed for a relatively clear assessment of the fit between the model and the data. The design of the study insured that the couple discussed one issue at a time until a resolution or impasse was reached in the discussion. One of the problems with analyzing the fit of the model with the data from the play was that the couple in the play changed issues frequently. The present study was designed so that the couple discussed only one issue for a sufficient length of time so that the changes from state structure to state structure could be monitored. Furthermore, since only the best data, i.e., most clear and unambiguous, were used, the model could be more clearly interpreted.

In order to assure that the design of the study yielded data which maximized a clear assessment of the fit of the model, some sacrifices in the "life-likeness" of the marital interaction were required. Undoubtedly, most interaction jumps from one issue to another and explores areas

Table 7.13. Data for the Second Session with the Issue "Husband Believes in Wife" (Recorded at Five-Second Intervals)

	Minutes											
Seconds	H 1	W	H 2	W	H 3	W	H 4	W	H 5	W	H 6	W
5	+△+ + +B·+B=+B	+△+ +	+△+ + +B·+B=+B	+△+ +	+△+ + B·I=I	+△+ −	+△+ +	+△+ +	+△− + I·I=B	+△+ −	−△− + B·B=B	−△− +
10	+△+ +	+△+ +	+△+ +	+△+ +	+△+ + +B·+B=+B	+△+ +	+△+ +	+△+ +	+△− + I·B=B	+△+ +	−△− +	−△− +
15	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	+△− + I·B=B	+△+ −	−△− +	−△− +
20	+△+ −	+△+ +	+△+ +	+△+ +	+△+ + B·I=I	+△+ −	+△+ +	+△+ +	+△− + I·B = B	+△+ +	−△− +	−△− +
25	+△+ + +B·+B=+B	+△+ +	+△+ +	+△+ +	+△+ + +B·+B=+B	+△+ +	+△+ − I·I=I	+△+ −	+△− +	+△+ +	−△− +	−△− +
30	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	+△+ + +B·+B=+B	+△+ +	+△− +	+△+ +		
35	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	−△+ + I·B=I	+△+ +	+△− +	+△+ +		
40	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	−△+ +	+△+ +	−△− + B·B=B	+△+ +		
45	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	−△− + B·B=B	+△+ +	−△− +	+△+ +		
50	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	−△− +	+△+ +	−△− +	+△+ +		
55	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	−△− +	+△+ +	−△− + B·I=I	+△− +		
60	+△+ − I·B=I	+△+ +	+△+ +	+△+ +	+△+ +	+△+ +	−△− +	+△+ +	−△− + B·I=I	−△− −		

Table 7.14. Data for the Second Session with the Issue "Wife Believes in Husband" (Recorded at Five-Second Intervals)

	Minutes											
Seconds	H 1	W	H 2	W	H 3	W	H 4	W	H 5	W	H 6	W
5	-Δ- + B·B=B	+Δ+ +	-Δ- + B·B=B	+Δ+ +	-Δ- + B·I=I	+Δ+ -	-Δ- +	+Δ- +	-Δ- + B·B=B	+Δ- -	-Δ- + B·I=I	+Δ- +
10	-Δ- +	+Δ+ +	-Δ- +	+Δ+ +	-Δ- + B·B=B	+Δ+ +	-Δ- +	+Δ- +	-Δ- + B·I=I	+Δ- +	-Δ- +	+Δ- +
15	-Δ- +	+Δ+ +	-Δ- +	+Δ+ +	-Δ- +	+Δ+ +	-Δ- +	+Δ- +	-Δ- + B·B=B	+Δ- +	-Δ- +	+Δ- +
20	-Δ- - I·B=I	+Δ+ +	-Δ- +	+Δ+ +	-Δ- + B·I=I	+Δ+ -	-Δ- +	+Δ- +	-Δ- + B·I=I	+Δ- +	-Δ- +	+Δ- +
25	-Δ- + B·B=B	+Δ+ +	-Δ- +	+Δ+ +	-Δ- + B·B=B	+Δ+ +	-Δ- - I·B=I	+Δ- -	-Δ- +	+Δ- +	-Δ- +	+Δ- +
30	-Δ- +	+Δ+ +	-Δ- +	+Δ+ +	-Δ- +	+Δ+ +	-Δ- + B·I=I	+Δ- +	-Δ- +	+Δ- +		
35	-Δ- +	+Δ+ +	-Δ- +	+Δ+ +	-Δ- + B·I=I	+Δ- +	-Δ- +	+Δ- +	-Δ- +	+Δ- +		
40	-Δ- + B·I=B	+Δ- +	-Δ- +	+Δ+ +	-Δ- +	+Δ- +	-Δ- +	+Δ- +	-Δ- +	+Δ- +		
45	-Δ- +	+Δ- +	-Δ- +	+Δ+ +	-Δ- +	+Δ- +	-Δ- +	+Δ- +	-Δ- +	+Δ- +		
50	-Δ- +	+Δ- +	-Δ- +	+Δ+ +	-Δ- +	+Δ- +	-Δ- +	+Δ- +	-Δ- +	+Δ- +		
55	-Δ- +	+Δ- +	-Δ- +	+Δ+ +	-Δ- +	+Δ- +	-Δ- +	+Δ- +	-Δ- +	+Δ- +		
60	-Δ- - I·I=B	+Δ- +	-Δ- +	+Δ+ +	-Δ- +	+Δ- +	-Δ- +	+Δ- +	-Δ- + B·B=B	+Δ- -		

Table 7.15. Data for the Fourth Session with the Issue "Husband is Mean with Wife" (Recorded at Five-Second Intervals)

Seconds	Minutes													
	H 1	W	H 2	W	H 3	W	H 4	W	H 5	W	H 6	W	H 7	W
5	−Δ− + B·B=B	−Δ− +	Δ +	Δ +	Δ +	Δ −	−Δ− + B·I=I	−Δ− −	−Δ− + B·B=B	−Δ− +	Δ +	Δ +	Δ +	Δ −
10	Δ +	Δ +	Δ +	Δ [illegible]	Δ +	Δ −	−Δ− + B·B=B	−Δ− +	Δ +	Δ +	Δ +	Δ +	−Δ− + B·B=B	−Δ− +
15	−Δ− + B·I=I	−Δ− −	Δ +	Δ +	−Δ− + B·B=B	−Δ− +	Δ +	Δ +	Δ +	Δ +	Δ +	Δ +		
20	−Δ− + B·B=B	−Δ− +	Δ +	Δ +	Δ +	Δ +	−Δ− + B·I=I	−Δ− −	Δ +	Δ +	Δ +	Δ +		
25	Δ +	Δ +	Δ +	Δ +	Δ +	Δ +	−Δ− + B·B=B	−Δ− +	Δ +	Δ +	Δ +	Δ +		
30	Δ +	Δ +	Δ +	Δ +	Δ +	Δ +	Δ +	Δ +	Δ +	Δ +	Δ +	Δ +		
35	Δ +	Δ +	Δ +	Δ +	Δ +	Δ +	−Δ− − I·B=I	−Δ− +	Δ +	Δ +	−Δ− + B·I=I	−Δ− −		
40	Δ +	Δ +	Δ +	Δ +	Δ +	Δ +	−Δ− + B·B=B	−Δ− +	Δ +	Δ +	Δ +	Δ −		
45	Δ	Δ	−Δ− −I·−I=B	−Δ−	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ		
50	Δ +	Δ +	Δ −	Δ −	Δ +	Δ +	Δ +	Δ +	Δ +	Δ +	Δ +	Δ −		
55	Δ +	Δ +	Δ −	Δ −	Δ +	Δ +	Δ +	Δ +	Δ +	Δ +	Δ +	Δ −		
60	Δ +	Δ +	−Δ− + B·I=I	−Δ− −	Δ +	Δ +	−Δ− − I·B=I	−Δ− +	Δ +	Δ +	Δ +	Δ −		

Table 7.16. Data for the Fourth Session with the Issue "Wife is Mean with Husband" (Recorded at Five-Second Intervals)

Seconds	Minutes													
	H 1	W	H 2	W	H 3	W	H 4	W	H 5	W	H 6	W	H 7	W
5	+△+ + B·B=B	−△− +	△ +	△ +	△ +	△ −	+△+ + B·B=B	+△− −	+△+ + B·l=l	+△− +	△ +	△ +	+△+ + B·l=l	+△+ −
10	△ +	△ +	△ +	△ +	△ +	△ −	+△+ + B·l=l	+△− +	△ +	△ +	△ +	△ +	+△+ + B·l=l	+△− +
15	+△+ + B·l=l	−△− −	△ +	△ +	+△+ + B·B=B	−△− +	△ +	△ +	△ +	△ +	△ +	△ +		
20	+△+ + B·B=B	−△− +	△ +	△ +	△ +	△ +	+△+ + B·B=B	+△− −	△ +	△ +	△ +	△ +		
25	△ +	△ +	△ +	△ +	△ +	△ +	+△+ + B·l=B	+△− +	△ +	△ +	△ +	△ +		
30	△ +	△ +	△ +	△ +	△ +	△ +	+△+ +	+△− +	△ +	△ +	+△+ +	+△− +		
35	△ +	△ +	△ +	△ +	△ +	△ +	−△+ − B·l=B	+△− +	△ +	△ +	+△+ + B·B=B	+△− −		
40	△ +	△ +	+△+ +	−△− +	+△+ + B·l=l	+△− +	−△+ + l·l=B	+△− +	△ +	△ +	+△+ +	+△− −		
45	△ +	△ +	+△+ − l·l=B	−△− −	△ +	△ +	△ +	△ +	△ +	△ +	+△+ +	+△− −		
50	△ +	△ +	△ −	△ −	△ +	△ +	△ +	△ +	△ +	△ +	+△+ +	+△− −		
55	△ +	△ +	△ −	△ −	△ +	△ +	+△+ + B·l=l	+△− +	△ +	△ +	+△+ +	+△− −		
60	△ +	△ +	+△+ + B·l=l	−△− −	△ +	△ +	+△+ − l·l=B	+△− +	△ +	△ +	+△+ +	+△− −		

which might seem irrelevant. In the case of the present study, the married couple were task oriented in that they were instructed to discuss one issue. This excluded some of the possible lines followed in normal, everyday interaction, such as changing the subject or avoiding the subject by getting up to pursue some activity like washing dishes or watching the hockey game. In fact, Rosenblatt and Cunningham (1976) report that families often use television-watching to avoid or reduce tense interactions in the family. So, in this sense, the interaction in the laboratory is not like it might be at home where television, work, children, etc., can be used to avoid or defuse a tense interaction or change issues.

On the other hand, most authors working in this area have employed laboratory observation rather than naturalistic observation (see Chapter III). The work that has been done in home, as well as laboratory settings, has reported considerable correspondence between data gathered in these two settings as well as other settings (Patterson and Cobb, 1971; Patterson, Hops and Weiss, 1975). However, even in these naturalistic settings, the observers have insisted on having the television off and limiting movements in the home so that some observation of interaction is indeed possible. Probably the most valid indicator that the present study bears some correspondence to normal interaction is the testimonial of the respondents. After the taping was finished, the investigator said to the respondents that the results of this study and its relevance for the couple depended on how similar their laboratory interaction was to their normal everyday interaction. The husband, supported by the agreement of the wife, said that he believed it to be very similar. The investigator then said that perhaps at home there would be more touching and physical affection and both respondents laughed, and said "no." This unsolicited testimonial is perhaps the clearest indication of a correspondence between the data and what transpires in normal interaction.

Although the closeness of the correspondence between the marital interaction in the controlled setting and the natural setting is impossible to accurately assess, the fit between the data and the model can be assessed.

The first question to be asked in regard to fit is "Does the observed distribution of state structures conform to the distribution expected by the model?" In order to answer this question, the information in Table 7.17 is examined. This table aggregates the state structures for both session two and four.

Table 7.17. Observed Distribution of State Structures for Sessions Two and Four Compared to Expected Distribution of State Structures

State Structure	Frequency		Proportion	
	Observed	Expected	Observed	Expected
+B • +B = +B	36	17.4	0.129	0.625
B • B = B	125	52.1	0.453	0.1875
I • I = B	11	52.1	0.039	0.1875
I • B = I	13	69.5	0.046	0.25
B • I = I	90	69.5	0.32	0.25
-I • -I = +B	3	17.4	0.01	0.625
	278	278	0.99	1.0

(χ^2 significant at .001)

Table 7.17 reveals a most notable departure from the expected outcomes generated by the model. About 77% of the observed state structures falls into either of two state structures, B • B = B or B • I = I. This unexpected discrepancy clearly means that the data do not even closely approximate the expected distribution.

The discrepancy found in Table 7.17 might be due to the failure of the axiom of least cost. That is, the distribution of state structures in the data might be divergent from the expected distribution because the individuals change more than one element of their systems of orientation at a time. It will be recalled that the transitions from time one (t_1) to time two (t_2) in the balancing process were hypothesized to follow the principle of least cost. This implies that as the dyad struggles for complete positive balance it attempts to make the fewest possible number of changes. Table 7.18 shows the frequency and percentage of sign changes for all state structures aggregated for both sessions.

Table 7.18. Frequency and Percentage of Sign Changes from t_1 to t_2 for All State Structures

Number of Signs Changed	Frequency	Percentage (%)
1	59	86.7
2	9	13.3
3	0	0
4	0	0
5	0	0
6	0	0

The data presented in Table 7.18 strongly support the least cost axiom. The preponderance of transitions from one state structure to another occurs with only one sign change.

Related to the sign changes is the balancing process. The balancing process is modelled by the Markov chain. The Markov model is a model of the balancing process for state structure transitions within the same issue. There are four issues contained in the two sessions, i.e., two issues in the second session and two in the fourth session.

These four issue transition matrices are presented as Tables 7.19, 7.20, 7.21 and 7.22. Note that the parentheses in each cell of these matrices contain the expected transition probabilities.

Table 7.19. Transition Matrix for Observed and Expected State Structure Transitions for the Issue "Husband Believes in Wife" Second Session

	+B•+B=+B	B•I=I	I•B=I	I•I=B	B•B=B	-I•-I=+B
+B•+B=+B	(1)	3	3	1		
B•I=I	3 (.09)			(.454)	1 (.454)	
I•B=I	2 (.09)			1 (.454)	2 (.454)	
I•I=B	1	(.5)	1 (.5)			
B•B=B		1 (.5)	(.5)	1		
-I•-I=+B		(.5)	(.5)			

Table 7.20. Transition Matrix for Observed and Expected State Structure Transitions for the Issue "Wife Believes in Husband" Second Session

	+B•+B=+B	B•I=I	I•B=I	I•I=B	B•B=B	-I•-I=+B
+B•+B=+B	(1)					
B•I=I	(.09)			1 (.454)	5 (.454)	
I•B=I	(.09)	1		(.454)	1 (.454)	
I•I=B		(.5)	(.5)		1	
B•B=B		7 (.5)	1 (.5)			
-I•-I=+B		(.5)	(.5)			

The data in Table 7.19 are obviously discrepant from the expected transitions. The most glaring difference between the observed and expected distributions of state structure transitions in Table 7.19 is that there are nine transitions to theoretically unexpected cells.

Furthermore, the largest proportion (0.88) of these unexpected transitions comes about from the oscillation between the absorbing state structure +B • +B = +B and B • I = I, I • B = I or I • I = B. This cast considerable doubt on the conception of the balancing process as an absorbing process. From the matrix presented in Table 7.19 it is obvious that with 45% of the data misclassified according to the model's expectations this represents a rather poor fit between the data and model.

Table 7.20 reveals that only 16.6% of the data is misclassified according to the theoretical expectations. However, two cells contain 66.6% of the cases. Although this is not an expected outcome, the sample size (18) is so small that it is difficult to assess this apparent anomaly. It may well be due to random fluctuations. Certainly, the fit between the model and data in Table 7.20 is not as discrepant as in Table 7.19. Nonetheless, it is still far from convincing.

Table 7.21. Transition Matrix for Observed and Expected State Structure Transitions for the Issue "Husband is Mean with Wife" Fourth Session

	B+•+B=+B	B•I=I	I•B=I	I•I=B	B•B=B	-I•-I=+B
+B•+B=+B	(1)					
B•I=I	(.09)			(.454)	5 (.454)	
I•B=I	(.09)			(.454)	2 (.454)	
I•I=B		(.5)	(.5)			
B•B=B		4 (.5)	2 (.5)			1
-I•-I=+B		1 (.5)	(.5)			

Table 7.21 reveals a closer fit between the model and data than did the two previous tables. However, as in Table 7.20, Table 7.21 shows the same pattern of concentration in only two cells, B • B = B to B •• I = I and B • I = I to B • B = B. In this case 60% of the data is in one of these two cells. As well, there are two cases in Table 7.21 which are misclassified. Both cases of misclassification involve the state structure -I • -I = +B. This particular state structure was deemed theoretically unexpected except as a starting state. The reason for this was that the axiom of positivity suggested that a dyadic relationship would not work in the negative direction. The data tend to cast some doubt on this axiom. Although Table 7.21 exemplifies a somewhat better fit than the previous matrices, it still presents some anomalies.

Table 7.22. Transition Matrix for Observed and Expected State Structure Transitions for the Issue "Wife is Mean with Husband" Fourth Session

	+B•+B=+B	B•I=I	I•B=I	I•I=B	B•B=B	-I•-I=+B
+B•+B=+B	(1)					
B•I=I	(.09)			2 (.454)	5 (.454)	
I•B=I	(.09)			(.454)	(.454)	
I•I=B		3 (.5)	(.5)			
B•B=B		5 (.5)	(.5)	1		
-I•-I=+B		(.5)	(.5)			

Table 7.22 again presents some anomalies to the theoretical expectations. Again, as with the two previous tables, approximately 62% of the cases is contained in only two cells. There is only one example of misclassification in Table 7.22. Otherwise Table 7.22 conforms more

closely to the theoretical expectations than the previous examples. Yet this closeness is far from confirmatory.

Several things have been noted from an inspection of Tables 7.19 to 7.22. First, there appears a tendency for the system to oscillate between only two states. In Table 7.19 this oscillation is between +B · +B = +B and B · I = I. In the other three tables, the oscillation is between B · B = B and B · I = I. There is undoubtedly a pattern in both of these oscillations which might lead to the belief that they are idiosyncratic to the couple studied. Note that the husband in most cases prefers to be in individual balance. The wife is the one who apparently oscillates between individual balance and imbalance. These idiosyncracies may be the result of either the issues discussed or of the particular idiosyncracies of this couple. Such oscillations may well be smoothed out and in conformity with the model when a larger sample of couples randomizes such idiosyncratic effects. Hence, since it is possible to identify a distinct pattern, and since this pattern may well be idiosyncratic, it is premature to be too critical of the model and to pursue corrections on this account.

However, this is not to say that the data presented in Tables 7.19 to 7.22 do not prompt some reevaluation of aspects of the model. Two anomalies appear in the data which need some consideration. The fact that in Table 7.19 the state structure oscillates in and out of the absorbing state leads to a reconsideration of the notion of complete positivity as an absorbing state. Furthermore, the reevaluation of the positivity axiom is further prompted by the occurrence of the totally negative structure, -I · -I = +B, in Table 7.21. According to the positivity axiom, this state would occur as a starting state only, and yet in Table 7.20 it is a transition state. However, the model is a probabilistic one which implies that, although impermissible transitions occur, they do not occur frequently. The absorption state in this interpretation should show greater stability over time than any of the less positive states with the corollary that the most negative state structure, -I · -I = +B, would show the least stability. The way in which the relative stability of each state structure may be assessed is by examining the number of times a state structure remains unchanged. That is, the data are sampled at five-second intervals and the most stable state structure would transition to itself the greatest proportion of its total transitions. Table 7.23 presents the data germane to an analysis of state structure stability.

Table 7.23. Rank Ordering of State Structures in Terms of Stability over Time for All Sessions

Order	State Structure	Frequency (f) Transition to Itself	Total (N) Occurrences	(%) f/N
1	+B · +B = +B	31	37	83.7
2	B · B = B	99	125	79.2
3	B · I = I	63	90	70.0
4	-I · -I = +B	2	2	66.6
5	I · I = B	4	10	40.0
6	I · B = I	4	11	36.3

Table 7.23 reports that the state structure which is completely positive is the most stable over time. Second most stable is the totally balanced state structure, B . B = B. This finding certainly reduces the doubt that the state structure, +B . +B = +B functions as an absorbing state since, in 83.7% of its transitions at five-second intervals, it moves to itself. Furthermore, this absorbing state structure only occurs

in one issue in the second session. In that session this state structure accounts for 57% of the state structures in that session (see Table 7.13). Thus, the absorbing state conception and the positivity axiom seem to receive strong support from this evidence.

The second anomaly threatening the positivity axiom is that there is a transition to the completely negative state structure, -I · -I = +B. Although the rank ordering in Table 7.23 ranks this state structure as fourth out of the six places, this is a bit misleading. Note that the last three state structures are all plagued by a small number of total occurrences (N). This, of course, means that the percentages of f/N should not be assumed as reliable estimates. Furthermore, it is interesting to note that the totally negative state structure occurs only three times out of 278, or approximately 1% of the time. This further attests to the relative infrequency of this state structure and supports the positivity axiom of the model. Even though there exists these anomalies in the data, they do not appear as sufficient evidence to induce a reconceptualization of the positivity axiom.

Another area in which the model can be assessed as to fit is the area of uncertainty for each state structure. It will be recalled that uncertainty was partitioned into those structures with only negative affect; those with only negative cognition; and, those with both negative cognition and affect. Table 7.24 reports the observed uncertainty for each state structure and Table 7.25 shows the expected distribution of uncertainty for each state structure.

Compare the observed distribution of uncertainty (Table 7.24) to the expected distribution of uncertainty (Table 7.25). An inspection reveals that the fit is very poor between the expected percentages of the

Recall that the reason this methodology was employed was so that a starting state where there is negativity could be identified. Otherwise, the investigator might pick issues where there is agreement and, hence, no need to reduce uncertainty. However, it is likely that the lack of fit between Tables 7.24 and 7.25 is an artifactual result of the research design.

In summary, the fit of the expected values generated by the model, and the corresponding values from the data, are analyzed in several respects. First, the total distribution of state structures (Table 7.17) revealed a marked discrepancy between expected and observed values. One possible reason for this discrepancy was suggested to be the axiom of least cost. However, in an analysis of this axiom (Table 7.18) it was found to be very strongly supported by the data. The subsequent discussion of the distribution of uncertainty pointed out that the lack of fit may be due to an artifact of the methodology, i.e., starting with negative cognitions. This same artifact undoubtedly was responsible for the poor fit between the observed distribution of state structures and the expected distribution (Table 7.17).

In regard to the fit of the Markov model with the state structure transitions in the data, it was found that each of the four issue statement matrices showed some misclassification. Most of the misclassification in Table 7.19 is accounted for by transitions in and out of the absorbing state, +B • +B = +B. This anomaly led to an analysis of the stability of each state structure since the notion of the absorbing state was obviously subject to question. The analysis of stability (Table 7.23) supported the notion of the absorbing state and, hence, the axiom of positivity. The other cases of misclassification are small enough where these may be due to random effects. In fact, the total percentage of misclassifications is 20.2% and that is skewed in an upwards direction due to the anomaly of the absorbing state in Table 7.19 (45%).

Table 7.26. Percentage of Misclassified Data in Tables 7.19, 7.20, 7.21 and 7.22

Table	% Misclassification
7.19	45
7.20	16.6
7.21	13.3
7.22	6.25

In conclusion, the axioms of least cost and positivity have been examined and vindicated by the data analysis. The analysis of uncertainty suffered from methodological artifacts so as to make any conclusions impossible in this area. The overall fit of the model is not perfect by any means; however, there appears sufficient support to encourage a study with a large sample of couples.

This case study has served to aid in the examination of the axioms by revealing anomalies in the data. Furthermore, it has provided insights into some of the methodological problems that must be faced in future examinations of the model. Most notably it has shown that a revealed differences technique ends in only allowing a partial evaluation of the model. This case study suggests that the axioms are well-supported and that further investigation is a justifiable endeavor.

7.12 Results: Interpretation

The model of the systems of orientation provides a means whereby the interaction of the married couple can be mapped. This topographical approach reveals the terrain traversed by the couple as they interact in terms of the two individual systems of orientation and the relationship.

The 30 items drawn from the IPM which were administered to the couple reveal the agreement and understanding the couple have at the beginning of the laboratory condition. The percentages of agreement and understanding are presented in Table 7.27.

Table 7.27. Percentages of Agreement and Understanding for 30 IPM Items

	% Understanding	% Misunderstanding	
Agreement	50 (15)	13.3 (4)	
Disagreement	3.3 (1)	33.3 (10)	
			(30) 100%

Table 7.27 reveals that 83.3% of the items are either scored as agreement-understanding or disagreement-misunderstanding. In order to gain some insight into the meaning of these percentages, they can be compared to results reported by Laing, Phillipson and Lee (1966). Laing, Phillipson and Lee (1966) report agreement and understanding for 12 disturbed and ten nondisturbed couples on the 60 IPM items. The disturbed couples were designated as such because they were seeking help with their relationships, and the nondisturbed couples were selected by doctors as couples satisfied with their marriages. Although there are obvious problems with the selection criteria, and the classification as disturbed and nondisturbed couples, this is the only relevant sample that has taken the IPM. Another problem with such a comparison is that the Laing, Phillipson and Lee study administered the full IPM, whereas the

present study only administered a random sample of 30 items, one-half the full complement of items.

Laing, Phillipson and Lee report that the disturbed couples revealed agreement and understanding on about 57.9% of the items whereas the nondisturbed couples showed agreement and understanding on about 89.5% of the items. Note that the couple in this study is close to the percentage reported for the disturbed couples in Laing, Phillipson and Lee. Laing and his associates report that the disturbed couples showed disagreement and misunderstanding on 20% of the items, whereas the nondisturbed couples revealed only 6.6%. Again, the couple in the present study revealed 33.3% disagreement and misunderstanding; which corresponds more closely to Laing's disturbed than nondisturbed group.

Although this comparison is interesting, it is of course insufficient for any categorization of the couple in this study. The methods of selection of Laing's couples, as well as the small number of couples, leaves open the possibility that his results in no way represent the class of couples designated as disturbed or nondisturbed. Furthermore, since the present study uses only half the items used by Laing and his associates, there is no guarantee that these items are not biased in a negative direction.

Other indicators about the relationship can aid the interpretation of the results. Turning to an analysis of the topography of the couple's interaction, it is possible to summarize the interaction by the measurement of the degree of positive balance [+b(G)] in the graphs. The degree of positive balance summarizes the total proportion of positivity for all state structures sampled at five-second intervals for each issue statement.

Table 7.28. The Degree of Positive Balance [+b(G)] for Husband, Wife and Relationship for Each Issue

	[+b(G)]		
	Husband	Wife	Relationship
2nd Session			
Husband believes in wife	.794	.902	.841
Wife believes in husband	.318	.764	.502
4th Session			
Husband is mean with wife	.311	.261	.855
Wife is mean with husband	.950	.459	.445

Table 7.28 gives a reading on the amount of individual system positive balance and relationship positive balance. The degree of positive balance in the relationship reveals the extent to which the couple agree, understand and express affect in the same direction. Note that the relationship, according to Table 7.28, is very positive in the two issue statements "Husband believes in wife" and "Husband is mean with wife." This means that there is a large amount of agreement and understanding in their interaction on these issues. However, the issue statements, "Wife believes in husband" and "Wife is mean with husband," both reveal a much lower amount of agreement and understanding. Therefore, the wife is the focus of disagreement and misunderstanding in both sessions.

Note from Table 7.28 that neither spouse exhibits a marked pattern toward positivity. However, the husband does reveal a pattern toward individual balance. This pattern is easily recognized in Table 7.29. Note that, according to Table 7.29, the husband maintains a consistently high proportion of the total possible number of balanced states.

Table 7.29. Number of Times (At Five-second Intervals) Each Individual System of Orientation is in a Balanced State

	Number of Times in Balanced State	
	Husband	Wife
2nd Session		
Husband believes in wife	53 (81.5%)	57 (87.6%)
Wife believes in husband	62 (95.4%)	27 (41.5%)
4th Session		
Husband is mean with wife	69 (93.2%)	58 (78.4%)
Wife is mean with husband	67 (90.5%)	32 (43.2%)

However, the wife increases in the proportion of imbalance when the two issue statements which focus upon her are discussed. This means that she has a difficult time maintaining individual system consistency during these two discussions. This finding is consistent with that reported in Table 7.28; that is, the relationship system shows significantly lower values for the degree of positive balance [+b(G)] for the two issue statements "Wife believes in husband" and "Wife is mean with husband" reveal the greatest departure from positive balance in the relationship system and the greatest individual system imbalance for the wife. Since the affect is the same for both issue statements for session two, the difference between the wife's balance on the issue statement "Husband believes in wife" and the statement "Wife believes in husband" is due to the cognitive variables. The same is true for the difference between the wife's balance on the two issue statements in the fourth session. Thus, the wife's individual system of orientation holding negative cognitions about either her husband's view or in terms of her own view of these two issue statements results in imbalance rather than balance.

An examination of the affectual patterns in the relationship reveals that the wife consistently exhibits a greater degree of negative affect than does the husband. Examine Table 7.30. Table 7.30 reveals that the wife shows at least twice the amount of negative affect in each session than does the husband. The amount of negative affect is not issue statement specific and, hence, reveals this dimension for the overall relationship. This is to say that this would appear as a rather consistent component in the relationship.

Table 7.30: Percentage of Negative Affect Expressed by the Husband and Wife Per Session

	% Negative Affect	
	Husband	Wife
Second Session	4.6	9.2
Fourth Session	6.8	21.6

Even though the wife may send a greater proportion of negative affectual messages than the husband, these messages may vary in clarity. For example, an individual may send a positive facial cue and yet move their body position away from the other person. This distancing motion is considered to be an expression of negative affect. Recall that, according to the Gottman coding scheme (CISS), there are four channels for affectual messages, i.e., face, voice, speech disturbances, and body movement. In Gottman, Markman and Notarius (1977) the coding procedure was such that if a value for the face was found then the other channels were not coded. However, in the present study all four channels were coded at five-second intervals. If the same affectual message is carried on all four channels, then there exists total redundancy. Redundancy in this sense gives an idea as to the clarity of the message to the receiver as well as the communicational competence of the sender. Obviously, a highly redundant message is efficient whereas a message of low redundancy is confusing. Table 7.31 reports the percentage of redundancy of affect for the husband and wife. Table 7.31 reveals that both the husband and wife send some unclear affectual messages. However, it seems that when one spouse is sending unclear affectual messages, the other spouse compensates by being more clear. If this is the case for general patterns of communication of affect, it would imply a persistent uncertainty on the part of one spouse as to the affectual message being sent by the other. Thus, the relationship would be characterized by rather problematic communication of affect.

Table 7.31. Percentage of Redundancy of Affect for the Husband and Wife Per Session

	Husband	Wife
Second Session	78.5%	43 %
Fourth Session	56.7%	71.6%

In summary, the general picture drawn of the marital interaction comes from two sources, i.e., the IPM questionnaire responses and the map of state structure transitions. The adapted IPM shows that when the couple agree that they also understand that they agree. However, when the couple disagree they often believe that they agree (see Table 7.27). The issues which focus upon the wife seem to create the greatest amounts of disagreement, misunderstanding and affectual difference (see Table 7.28). The husband tends to remain in a balanced state regardless of the issue statement. However, the wife tends toward imbalance, i.e., inconsistent structures, when the issue statement focuses upon her (Table 7.29). The wife tends to exhibit approximately twice to three times as much negative affect in the relationship as does the husband (Table 7.30). The affectual communication between the two spouses appears to be of a complementary nature. That is, one spouse sends clear affectual messages and the other sends more confused messages. This pattern does not seem associated with one particular spouse but characterizes the relationship. This pattern of communication might be problematic in that one spouse or the other is constantly unsure of whether or not they are loved or liked.

7.13 Conclusion

This chapter applies the model of interpersonal perception and communication to two data sets. One data set is from a portion of the Neil Simon play *Plaza Suite*. The other data set is from a case study of a married couple interacting in a controlled setting. Both data sets are used to illustrate three functions of the model, i.e., the operationalization of the model, the interpretive function and the fit of the model. Since the model requires aggregate data for any critical testing, the data from the case studies are used to further illuminate and clarify the model. Hence, this is more an application of the model to a data set than a test of the model.

The data collected from the Neil Simon play *Plaza Suite* represent a rather unique approach. This approach views the play as a proxy for behavior. In a way, the play is a literary model of behavior and the data collected from it represent a transformation, so that aspects of this literary model may be compared to the formal model of interpersonal perception and communication. The analysis of the interactional sequences of the play presents some areas of fit, such as the distribution of state structures and some areas of discrepancy such as the misclassification in the Markov chain. The misclassification, as well as other anomalies, are used to point to possible problem areas in the model. However, it must be remembered that this data set is a proxy for behavior and of such a limited nature that it cannot substantiate or refute any claims. What it does do is to show how the model can be operationalized, tested for fit, and how it may aid in the interpretation of interactional sequences.

The data gathered from the tape of a married couple interacting in a controlled setting must be viewed in somewhat of the same perspective as the data from the play. That is, these data are not sufficient to test the model but only shed a little light on how the model operates. The analysis of fit of these data does reveal strong support for the axioms of least costs and positivity. This support of these axioms is somewhat offset by anomalies in the Markov chain. However, some of these anomalies may be due to a methodological artifact of selecting negative states as starting states rather than selecting starting states at random. The model is, again, illuminated in terms of how it can be operationalized, how it interprets interactional sequences, and an analysis of fit.

This case study method of exploring a formal model has proven beneficial. It has demonstrated sufficient support and generated enthusiasm to continue work on the model. At the same time, the application has revealed unforeseen problems in methodology and areas of the model which require further work and elaboration. One such area is the need to develop the capacity to model equal interval time series data. And, finally, the application of the model has shown that formal models may have utility in areas such as literary interpretation and particularistic case studies.

CHAPTER VIII

CONCLUSION

This concluding chapter seeks to summarize, evaluate and pursue some of the implications of the model of interpersonal perception and communication. The model of interpersonal perception and communication proposed in this study is a theoretical model. Theoretically, it attempts to tie together the previously disparate theoretical areas of balance theory and Laing, Phillipson and Lee's (1966) work on interpersonal perception. Furthermore, the model tries to link the cognitive aspects from Laing and his associates and balance theory with the behavioral aspects in communication. In order to accomplish this task, the merging of formal theories, i.e., graph theory and information theory, is attempted. The final stage in the development of the model of interpersonal perception and communication is to link the variables in the model to specific measurement operations so that the model is empirically useful. Further examination and analysis are needed before any conclusion can be made as to the contribution the model actually makes in the area of interpersonal perception and communication. However, the present work does perform the function of bringing together previously disparate frameworks into a novel perspective. Such work cannot fail to shed new light on old theories as well as suggest new possibilities and directions for theorizing in interpersonal perception and communication.

8.1 Summary

Chapter II reviews the extant literature on interpersonal perception. Two theoretical approaches characterize most of the work in this area. One theoretical approach is that proposed by Laing, Phillipson and Lee (1966). The other approach is balance theory. It was noted that Laing's Level I and II perceptions are the same as the balance theory formulation of the person's perception of the object and perception of the other's view of the object. Empirically, the great bulk of the research in this area has been on the first two levels of perception. There has not been extensive research on Laing's Level III perception, and what has been done fails to indicate the explanatory power of Level III perceptions. Thus, theoretically and empirically, the emphasis is on the person's perception of the object and perception of the other's perception of the object and not on Level III perceptions.

Chapter III reviews the theoretical and empirical work in marriage and family communication. Theoretically, most authors suggest the use of the communication or information theory approach. However, these theoreticians have failed to apply this approach in their own work. Theoretically and empirically, many scholars in this area have failed to consider the importance of nonverbal behavior in interpersonal communication. Finally, the area of interpersonal communication in marriage and families does not articulate with the extant work on interpersonal perception.

Chapter IV points out that communication or information theory implies the importance of an articulation between interpersonal perception and communication. Information theory defines information as that part of a message that selects from a set of possible states in the receiver. Hence, information is measured by the change of state in the receiver. If the receiver is a member of a dyad, then the states of the receiver must be states of interpersonal perception, since communication is interpersonal. This rather crucial point ties together the previously disparate areas of interpersonal perception and interpersonal communication.

Chapter V proposes a formal model that unifies the theoretical work of Laing, Phillipson and Lee (1966) and balance theory with communication theory. The model is formalized with graph theory after showing that the formal constructs of the IPM and balance theory can both be formalized by graphs. A consideration of all possible dyadic graphs yields 2^6 graphs. These graphs are partitioned into six state structures following the axioms of balance, positivity, and least costs. These three axioms also specify the balancing process which is modelled by a Markov chain. Furthermore, the balancing process functions to reduce the uncertainty in the state structures. Thus, the transitions between state structures occurs because of the communication of information. Information is either cognitive or affectual. Though not universal, cognitions are generally transmitted on verbal channels and affect on nonverbal channels. Thus, by monitoring the transmission of information, it is possible to identify the state structure of the dyad.

Chapter VI further clarifies the proposed model by considering some methodological issues. The most important issue considered is the measurement of affect and cognition in the channels of communication. The degree of positive balance is suggested as a useful way to summarize aggregated state structures on either the same or different issues.

Chapter VII applies the model to two data sets. The application illustrates the operationalization of the model, the manner in which goodness of fit would be assessed, and the interpretive function of the model. The data drawn from the "Visitor from Mamaroneck" of Neil

Simon's *Plaza Suite* restricts the extent of a goodness of fit analysis. However, some rough approximation is possible. Interestingly enough, if one assumes that the play is an analogy to real life, and that the model is an analogy to real life, then the fit between the model and data gives some indication of the closeness of these two analogies to one another. The data from the video-taped interaction of the married couple are plagued by even more anomalies than the play; at least in terms of goodness of fit. Some of these anomalies are due to methodological artifacts. The anomalies that appeared to be contradictory to the axioms of least cost and positive balance were, on further analysis, found not to contradict these axioms. The fact that the axioms were supported by the data definitely is promising and suggests that further research is warranted.

8.2 Evaluation

The formal model of interpersonal perception and communication in the dyad unifies what have previously been two disparate areas of discourse. For this reason alone, the present work is believed to make a significant contribution to the discussion of dyadic interaction. However, there are other contributions as well. The focus on the importance of nonverbal communication, as well as verbal, may arouse new interest in this area. Certainly the viewpoint here is that research on marital communication cannot afford to look simply at the verbal content of statements.

Another contribution is that a technique is established by which literary sources can be used as sources of data. The wealth of analogic insight contained in literature should not be overlooked by the social sciences in their eagerness to demonstrate their claims for scientific status. As with all data, there are limitations and restrictions. For instance, literary data would be useless for inferences to real life populations. Nonetheless, this form of data may prove an excellent source of theoretical insight especially when coupled with precise formal models. For example, the literary data analyzed here revealed that a dyadic system may evolve toward a homeostatic value.

As with every work, there are several limitations and points of dispute as well as contributions. One area of concern is that a formal model is too restrictive in its assumptions to be of much empirical value. In the present case, the assumption of a closed dyadic system may be viewed by some as too unrealistic an assumption. However, the extent to which this is unrealistic depends on the unit of analysis and the fit between the model and empirical data. If the assumptions are unrealistic then the model will consistently not fit the data. From the initial assessment, however, this does not promise to be the case.

Another area of concern is that the model only uses qualitative levels of measurement. Usually the social scientist would ordinally scale affect and other such variables. In the model affect is simply treated as positive or negative. This is because the model simply calls for this level of measurement. Since the model multiplies the corresponding sides of graphs, any scaling of affect would have to be at least interval level. The problem is, of course, that the multiplication assumes additivity. An ordinal scale does not meet this assumption. However, the qualitative scale does in this particular case. Thus, the model can use either qualitative or interval measurements but ordinal scales cannot be used. Undoubtedly, this is a restriction and limitation of the model, though not a serious one. Much of the data available is qualitative. Furthermore, qualitative data in conjunction with a precise model are, in all probability, more useful than ordinal data without such a tool.

8.3 Implications and Further Research

As previously indicated, one of the functions of a formal model is to progress toward a theory. The formal model offers a precise and clear statement of the assumptions underlying a particular perspective. As the model interacts with empirical data, it might generate the insights that lead to theoretical lawlike statements. The model needs further elaboration for cases of N-adic interaction to be applicable to larger groups. As the model stands now it can be applied to dyadic relations in families such as mother-son, husband-wife, father-daughter, etc. Before the model is elaborated for N-adic relations, it is crucial that a careful consideration of the fit of the model to dyads be undertaken. If the model does not approximate the dyad, it is doubtful that an expansion is of much value.

One implication of the research undertaken in the present study is that it points out the need for a further formal elaboration of the model. The model needs to be expanded so that it can account for points sampled during interaction as well as state structure transitions. The foundation of this expansion is somewhat developed in the discussion in Chapter VII on the stability of the state structures. Using the axiom of positivity, it is possible to order the state structures. This ordering would give an idea as to which states would be most likely to transition to themselves at sample points. A hidden consequence of this elaboration of the model is that it implies a more detailed and well-elaborated Markov chain in which sampling points rather than just transitions are modelled. This elaborated model would not be as restrictive as the one employed in this study, and its empirical fit could be more easily assessed since data can be more easily gathered on sampling points than transitions between state structures.

Another area in which the model may have some application is in the area of marriage and family counselling. The model can be used to trace the topography of interaction between a married couple or two family members. This would entail the use of video-taped sequences of interaction in conjunction with the coding schemes cited in Chapter VII. The resulting data could be treated in a similar way to the treatment of the data from the play and married couple. Such a tool would enable marriage and family counsellors to have a measurable indicator of the state of a dyad. Furthermore, dyadic change could be solicited by focusing on communication patterns. This would also allow for the periodic reassessment of dyadic interaction and, hence, the direction and effectiveness of the counselling program could also be evaluated.

The case studies examined in this study only support the model to a limited extent. However, it is only possible to fully evaluate the fit of a stochastic model with a much larger sample than examined in this research. In this study, the results of the case studies are significant primarily in illustrating and illuminating what is believed to be a suggestive and promising formal model of interpersonal perception and communication.

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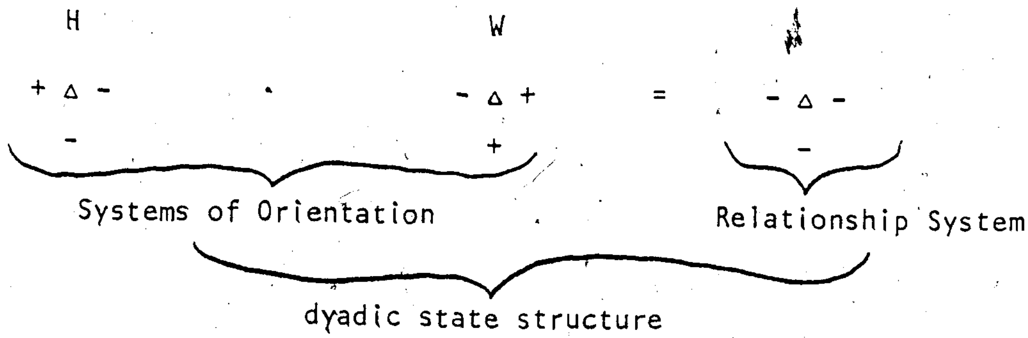
APPENDIX I

MATHEMATICAL APPENDIX

The balancing process changes from state to state until it reaches the absorption state of complete positive balance. There are six dyadic state structures. Each dyadic state structure is composed of two systems of orientation and the product of the two systems which is the relationship system. For example:



(B · I = I)

Figure AI-1

From this example it is easy to see that the dyadic state structure summarizes the state of the dyadic system and, hence, loses some of the detailed information contained in the diagram. For instance, from the diagram it is obvious that three sign changes are necessary before this system can be positively balanced. However, this information is lost in the dyadic state structure (B · I = I).

If the dyadic system were a completely determined system, then the loss of information encountered by using the dyadic state structures would be intolerable. In a determinate system (referring to the example) there would be only three changes of sign, and then positive balance would be achieved. However, this assumes that perception and communication is totally accurate and efficient. Such is not the case and, hence, a deterministic model is not deemed useful.

The balancing process is much more likely to resemble a probabilistic process. In particular, as pointed out by Flament (1963), the balancing process can be modeled as a particular kind of stochastic process called a Markov chain. Kemeny, Snell and Thompson (1956:148) define a Markov chain as follows:

> A *Markov chain process* is determined by specifying the following information: There is a given set of states $(s_1, s_2, \ldots, s_r)$. The process can be in one and only one of these states at a given time and it moves successively from one state to another. Each move is called a *step*. The probability that the process moves from s_i to s_j depends only on the state s_i that it occupied before the step. The *transition probability* p_{ij}, which gives the probability that the process will move from s_i to s_j, is given for every ordered pair of states. Also an initial *starting state* is specified at which the process is assumed to begin [italics in original].

In the conception of the balancing process, the state of complete positive balance ends the process. In other words, the system is in equilibrium in this state. There is a particular type of Markov chain which models this type of process. It is called an absorbing Markov chain. "A state in a Markov chain is an *absorbing state* if it is impossible to leave it. A Markov chain is *absorbing* if, (1) it has at least one absorbing state, and (2) from every state it is possible to go to an absorbing state (not necessarily in one step) [italics in original]" (Kemeny, Snell and Thompson, 1956:404). Hence, the balancing process would seem to be like an absorbing Markov chain.

In order to find the transition probabilities of the balancing process Markov chain, the possible states of the dyadic system must be enumerated as in Table AI-1.

From Table AI-1, it is immediately apparent that there are two rather extreme states. One is the absorbing state of complete positive balance that requires no sign changes. This is the state where both individual systems are totally negative. Since this state is the most

Table AI-1. Possible States and Number of Sign Changes Necessary

B • B = B	C	B • I = I (I • B = I)	C	I • I = B	C
+Δ+ +Δ+ = +Δ+ + + +	0	+Δ+ −Δ− = −Δ− + − −	3	−Δ− −Δ− = +Δ+ − − +	6
+Δ+ −Δ− = −Δ− + + +	2	+Δ+ +Δ+ = +Δ+ + − −	1	−Δ− +Δ+ = −Δ− − − +	4
+Δ+ +Δ− = +Δ− + − −	2	+Δ+ −Δ+ = −Δ+ + + +	1	−Δ− −Δ+ = +Δ− − + −	4
+Δ+ −Δ+ = −Δ+ + − −	2	+Δ+ +Δ− = +Δ− + + +	1	−Δ− +Δ− = −Δ+ − + −	4
−Δ− +Δ+ = −Δ− + + +	2	−Δ− −Δ− = +Δ+ + − −	5	+Δ+ −Δ− = −Δ− − − +	4
+Δ− +Δ+ = +Δ− − + −	2	−Δ− +Δ+ = −Δ− + − −	3	−Δ+ −Δ− = +Δ− + − −	4
−Δ+ +Δ+ = −Δ+ − + −	2	−Δ− −Δ+ = +Δ− + + +	3	+Δ− −Δ− = −Δ+ + − −	4
−Δ− −Δ− = +Δ+ + + +	4	−Δ− +Δ− = −Δ+ + + +	3	+Δ+ +Δ+ = +Δ+ − − +	2
+Δ− −Δ− = −Δ+ − + −	4	+Δ− −Δ− = −Δ+ − − +	5	+Δ+ −Δ+ = −Δ+ − + −	2
−Δ+ −Δ− = +Δ− − + −	4	+Δ− +Δ+ = +Δ− − − +	3	+Δ+ +Δ− = +Δ− − + −	2
−Δ− +Δ− = −Δ+ + − −	4	+Δ− −Δ+ = −Δ− − + −	3	−Δ+ +Δ+ = −Δ+ + − −	2
−Δ− −Δ+ = +Δ− + − −	4	+Δ− +Δ− = +Δ+ − + −	3	+Δ− +Δ+ = +Δ− + − −	2
+Δ− +Δ− = +Δ+ − − +	4	−Δ+ −Δ− = +Δ− − − +	5	−Δ+ −Δ+ = +Δ+ + + +	2
+Δ− −Δ+ = −Δ− − − +	4	−Δ+ +Δ+ = −Δ+ + − +	3	−Δ+ +Δ− = −Δ− + + +	2
−Δ+ +Δ− = −Δ− − − +	4	−Δ+ −Δ+ = +Δ+ − + −	3	+Δ− −Δ+ = +Δ+ + + +	2
−Δ+ −Δ+ = +Δ+ − − +	4	−Δ+ +Δ− = −Δ− − + −	3	+Δ− +Δ− = +Δ+ + + +	2

distant in sign changes from the absorbing state, it is possible to view it as the starting state and represent the process by a tree diagram (see Figure AI-2).

The relative frequencies of the state structures for each step in the balancing process can be found by counting the frequencies from Table AI-1. According to Figure AI-2, the absorbing state can be reached in six steps given complete information, accuracy of perception and communication. In such an ideal case, the investigator would require access to such complete information to use this model. In fact, it would be rare to find many cases where issues are measured in such detail. However, when such conditions as perfect communication and accuracy of perception can be assumed, then the process in Figure AI-2 is a six-stage Markov chain. The transition probabilities are found from state structure frequencies in Table AI-1. Table AI-2 is a transition matrix for this Markov chain. From the matrix in Table AI-2, it is clear that the process will reduce stepwise to the absorbing state. If the powers of the matrix are taken up to the sixth power, it is found that all states are absorbed. Another way of verifying this is to derive the fundamental matrix N $[N=(I-Q)^{-1}]$ which shows that all states are completely absorbed in six steps.

Table AI-2 represents a highly determined stochastic process. This process is for most purposes not of much value. For instance, in cases where issues are aggregated, the six-stage process cannot be used since the sign changes cannot be specified. Furthermore, the assumption of perfect communication between a couple can seldom, if ever, be made with any confidence. In fact, the state structures attest to this, since some of the products (relationships) show no understanding and,

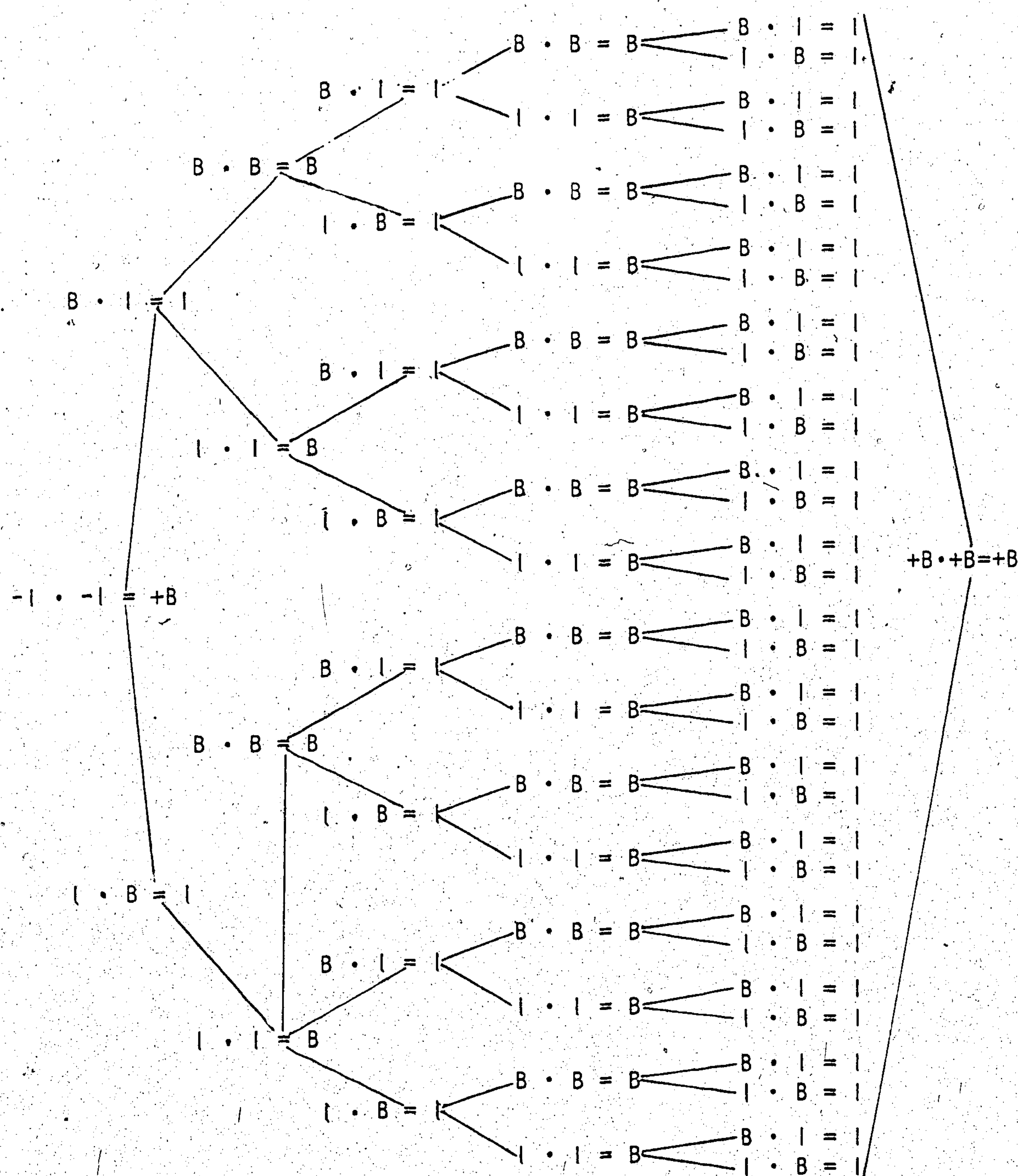


Figure AI-2. State Where Both Individual Systems are Totally Negative

Table AI-2. Six-Stage Markov Chain of State Structures

Sign		0	1		2		3		4		5		6
Changes	States	+B•+B=+B	B•I=I	I•B=I	B•B=B	I•I=B	B•I=I	I•B=I	B•B=B	I•I=B	B•I=I	I•B = I	-I•-I=+B
0	+B•+B=+B	1											
1	B•I=I	1											
	I•B=I	1											
2	B•B=B		0.5	0.5									
	I•I=B		0.5	0.5									
3	B•I=I				0.6	0.4							
	I•B=I				0.6	0.4							
4	B•B=B						0.5	0.5					
	I•I=B						0.5	0.5					
5	B•I=I								0.4	0.6			
	I•B=I								0.4	0.6			
6	-I•-I=+B										0.5	0.5	

hence, lack of communication efficiency.

Another approach to this process is to model the process by the transition probabilities of state structures alone. This would mean that such a model could be used in relation to aggregated issues as well as the study of individual issues. Table AI-3 presents this approach as a transition matrix.

Table AI-3. Transition Matrix for Dyadic State Structures

	+B•+B=+B	B•I=I	I•B=I	I•I=B	B•B=B	-I•-I=+B
+B•+B=+B	1					
B•I=I	0.09			0.454	0.454	
I•B=I	0.09			0.454	0.454	
I•I=B		0.5	0.5			
B•B=B		0.5	0.5			
-I•-I=+B		0.5	0.5			

The matrix in Table AI-3 can be partitioned into canonical form so as to derive the fundamental matrix N. Let the matrix in Table AI-3 be matrix P. When P is taken to some power n, all of the states are absorbed. However, more detailed information is available from the fundamental matrix N. The fundamental matrix gives the number of times on the average that a state structure will occur given the initial starting state structure. The fundamental matrix is derived by putting matrix P in canonical form as illustrated in Figure AI-3. The fundamental matrix N is equal to the inverse of matrix I - Q. Thus, for matrix P the fundamental matrix N is derived as illustrated in Figure AI-4.

The fundamental matrix N gives the mean number of times, starting

		r	s
P (canonical) =	r	I	0
	s	R	Q

where

r = absorbing states

s = nonabsorbing states

hence, matrix P is

	r	s			
r	1				
	0.09			0.454	0.454
	0.09			0.454	0.454
s		0.5	0.5		
		0.5	0.5		
		0.5	0.5		

Figure AI-3

$$Q = \begin{pmatrix} 0 & 0 & 0.454 & 0.454 & 0 \\ 0 & 0 & 0.454 & 0.454 & 0 \\ 0.5 & 0.5 & 0 & 0 & 0 \\ 0.5 & 0.5 & 0 & 0 & 0 \\ 0.5 & 0.5 & 0 & 0 & 0 \end{pmatrix}$$

$$I - Q = \begin{pmatrix} 1 & 0 & -0.454 & -0.454 & 0 \\ 0 & 1 & -0.454 & -0.454 & 0 \\ -0.5 & -0.5 & 1 & 0 & 0 \\ -0.5 & -0.5 & 0 & 1 & 0 \\ -0.5 & -0.5 & 0 & 0 & 1 \end{pmatrix}$$

$N = (I - Q)^{-1}$	B•I=I	I•B=I	I•I=B	B•B=B	-I•-I=+B
B•I=I	5.935	4.935	4.935	4.935	0.0
I•B=I	4.935	5.935	4.935	4.935	0.0
I•I=B	5.435	5.435	5.935	4.935	0.0
B•B=B	5.435	5.435	4.935	5.935	0.0
-I•-I=+B	5.435	5.435	4.935	4.935	1.0

Figure AI-4

in state structure B • I = I, that the process is in B • I = I (5.935), I • B = I (4.935), I • I = B (4.935), B • B = B (4.935) and -I • -I = +B

(0.0). However, a general statistic is available to summarize the process. The more general statistic is the average number of steps to absorption starting in some state of Q. This information is attained by multiplying matrix N by the column vector C as in Figure AI-5. This

$$NC = N \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{pmatrix} = \begin{matrix} 20.72 & B \cdot I = I \\ 20.72 & I \cdot B = I \\ 21.73 & I \cdot I = B \\ 21.73 & B \cdot B = B \\ 21.73 & -I \cdot -I = +B \end{matrix}$$

Figure AI-5

operation essentially sums the rows of N so as to yield the average number of times the process takes starting in each state. Thus, if the process starts in state structure B • I - I, it takes on the average about 21 (20.72) steps before absorption. From the vector NC, it is apparent that, no matter which state the process starts in, it will take approximately 21 to 22 steps before absorption.

APPENDIX II

ADAPTED INTERPERSONAL PERCEPTION METHOD (IPM) QUESTIONNAIRE

[illegible]lease [illegible]ach of the questions and blacken the square in the answe[illegible]rm t[illegible] how true you think each statement is:

[illegible] you [illegible]eel the statement is very true, then blacken the square [illegible] the [illegible] column.

I[illegible] feel the statement is slightly true, blacken underneath th[illegible]

I'f [illegible] is slightly untrue, blacken underneath the -.

If [illegible] is very untrue, blacken underneath --.

If y[illegible] really have no idea as to how to answer the question, then blac[illegible] the square ?.

Answer form:

	++	+	-	--	?
[illegible]					
[illegible]					

There are 30 items in the questionnaire. Each item is divided into two sections. Section A asks for your direct answer. Section B asks you to put the answer that you think your spouse would give.

It is best to do the questions quickly, your first thoughts will be the most useful.

A. How true do you think the following are?

1. She understand me.
2. I understand her.

Item 1

	++	+	-	--	?
1					
2					

B. But how would SHE answer the following:

1. "I understand him."
2. "He understands me."

	++	+	-	--	?
1					
2					

Item 2

A. How true do you think the following are:

1. She makes up my mind for me.

2. I make up her mind for her.

	‡	+	-	=		?
1						
2						

B. How would SHE answer the following?

1. "I make up his mind for him."

2. "He makes up my mind for me."

	‡	+	-	=		?
1						
2						

Item 4

A. How true do you think the following are?

1. She depends on me.

2. I depend on her.

	‡	+	-	=		?
1						
2						

B. How would SHE answer the following?

1. "I depend on him."

2. "He depends on me."

	‡	+	-	=		?
1						
2						

Item 7

A. How true do you think the following are:

1. She is disappointed in me.

2. I am disappointed in her.

	‡	+	-	=		?
1						
2						

B. How would SHE answer the following:

1. "I am disappointed in him."

2. "He is disappointed in me."

	‡	+	-	=		?
1						
2						

Item 10

A. How true do you think the following are?

1. She would like to get away from me.

2. I would like to get away from her.

	++	+	-	=	?
1					
2					

B. How would SHE answer the following?

1. "I would like to get away from him."

2. "He would like to get away from me."

	++	+	-	=	?
1					
2					

Item 11

A. How true do you think the following are:

1. She is afraid of me.

2. I am afraid of her.

	++	+	-	=	?
1					
2					

B. How would SHE answer the following?

1. "I am afraid of him."

2. "He is afraid of me."

	++	+	-	=	?
1					
2					

Item 12

A. How true do you think the following are?

1. She respects me.

2. I respect her.

	++	+	-	=	?
1					
2					

B. How would SHE answer the following?

1. "I respect him."

2. "He respects me."

	++	+	-	=	?
1					
2					

Item 13

A. How true do you think the following are?

1. She makes me the center of her world.

2. I make her the center of my world.

	++	+	-	--	?
1					
2					

B. How would SHE answer the following?

1. "I make him the center of my world."

2. "He makes me the center of his world."

	++	+	-	--	?
1					
2					

Item 14

A. How true do you think the following are?

1. She is mean with me.

2. I am mean with her.

	++	+	-	--	?
1					
2					

B. How would SHE answer the following?

1. "I am mean with him."

2. "He is mean with me."

	++	+	-	--	?
1					
2					

Item 15

A. How true do you think the following are?

1. She loves me.

2. I love her.

	++	+	-	--	?
1					
2					

B. How would SHE answer the following?

1. "I love him."

2. "He loves me."

	++	+	-	--	?
1					
2					

Item 16

A. How true do you think the following are?

1. She tries to outdo me.

2. I try to outdo her.

	++	+	-	--	?
1					
2					

B. How would SHE answer the following?

1. "I try to outdo him."

2. "He tries to outdo me."

	++	+	-	--	?
1					
2					

Item 17

A. How true do you think the following are?

1. She fights with me.

2. I fight with her.

	++	+	-	--	?
1					
2					

B. How would SHE answer the following?

1. "I fight with him."

2. "He fights with me."

	++	+	-	--	?
1					
2					

Item 19

A. How true do you think the following are?

1. She takes responsibility for me.

2. I take responsibility for her.

	++	+	-	--	?
1					
2					

B. How would SHE answer the following?

1. "I take responsibility for him."

2. "He takes responsibility for me."

	++	+	-	--	?
1					
2					

Item 20

A. How true do you think the following are?

1. She finds fault with me.

2. I find fault with her.

	++	+	-	--	?
1					
2					

B. How would SHE answer the following?

1. "I find fault with him."

2. "He finds fault with me."

	++	+	-	--	?
1					
2					

Item 24

A. How true do you think the following are?

1. She doubts me.

2. I doubt her.

	++	+	-	--	?
1					
2					

B. How would SHE answer the following:

1. " doubt him."

2. "He doubts me."

	++	+	-	--	?
1					
2					

Item 25

A. How true do you think the following are?

1. She makes contradictory demands on me.

2. I make contradictory demands on her.

	++	+	-	--	?
1					
2					

B. How would SHE answer the following?

1. "I make contradictory demands on him."

2. "He makes contradictory demands on me."

	++	+	-	--	?
1					
2					

Item 28

A. How true do you think the following are:

1. She is honest with me.

2. I am honest with her.

	++	+	-	--	?
1					
2					

B. How would SHE answer the following:

1. "I am honest with him."

2. "He is honest with me."

	++	+	-	--	?
1					
2					

Item 30

A. How true do you think the following are?

1. She analyzes me.

2. I analyze her.

	++	+	-	--	?
1					
2					

B. How would SHE answer the following?

1. "I analyze him."

2. "He analyzes me."

	++	+	-	--	?
1					
2					

Item 33

A. How true do you think the following are?

1. She expects too much of me.

2. I expect too much of her.

	++	+	-	--	?
1					
2					

B. How would SHE answer the following:

1. "I expect too much of him."

2. "He expects too much of me."

	++	+	-	--	?
1					
2					

Item 35

A. How true do you think the following are?

1. She worries about me.

2. I worry about her.

	++	+	-	--	?
1					
2					

B. How would SHE answer the following:

1. "I worry about him."

2. "He worries about me."

	++	+	-	--	?
1					
2					

Item 38

A. How true do you think the following are?

1. She won't let me be.

2. I won't let her be.

	++	+	-	--	?
1					
2					

B. How would SHE answer the following?

1. "I won't let him be."

2. "He won't let me be."

	++	+	-	--	?
1					
2					

Item 39

A. How true do you think the following are?

1. She blames me.

2. I blame her.

	++	+	-	--	?
1					
2					

B. How would SHE answer the following?

1. "I blame him."

2. "He blames me."

	++	+	-	--	?
1					
2					

Item 41

A. How true do you think the following are?

1. She deceives me.

2. I deceive her.

	‡	+	-	=	?
1					
2					

B. How would SHE answer the following?

1. "I deceive him."

2. "He deceives me."

	‡	+	-	=	?
1					
2					

Item 44

A. How true do you think the following are?

1. She has a warped view of me.

2. I have a warped view of her.

	‡	+	-	=	?
1					
2					

B. How would SHE answer the following?

1. "I have a warped view of him."

2. "He has a warped view of me."

	‡	+	-	=	?
1					
2					

Item 45

A. How true do you think the following are?

1. She readily forgives me.

2. I readily forgive her.

	‡	+	-	=	?
1					
2					

B. How would SHE answer the following:

1. "I readily forgive him."

2. "He readily forgives me."

	‡	+	-	=	?
1					
2					

Item 46

A. How true do you think the following are?

1. She puts me on a pedestal.

2. I put her on a pedestal.

	‡	+	-	=	?
1					
2					

B. How would SHE answer the following?

1. "I put him on a pedestal."

2. "He puts me on a pedestal."

	‡	+	-	=	?
1					
2					

Item 47

A. How true do you think the following are?

1. She is bitter towards me.

2. I am bitter towards her.

	‡	+	-	=	?
1					
2					

B. How would SHE answer the following?

1. "I am bitter towards him."

2. "He is bitter towards me."

	‡	+	-	=	?
1					
2					

Item 52

A. How true do you think the following are?

1. She bewilders me.

2. I bewilder her.

	‡	+	-	=	?
1					
2					

B. How would SHE answer the following?

1. "I bewilder him."

2. "He bewilders me."

	‡	+	-	=	?
1					
2					

Item 53

A. How true do you think the following are?

1. She believes in me.

2. I believe in her.

	‡	+	-	=	?
1					
2					

B. How would SHE answer the following?

1. "I believe in him."

2. "He believes in me."

	‡	+	-	=	?
1					
2					

Item 60

A. How true do you think the following are?

1. She is kind to me.

2. I am kind to her.

	‡	+	-	=	?
1					
2					

B. How would SHE answer the following?

1. "I am kind to him."

2. "He is kind to me."

	‡	+	-	=	?
1					
2					

APPENDIX III

COUPLES INTERACTION SCORING SYSTEM (CISS)

CONTENT CODES FOR AGREEMENT AND DISAGREEMENT

by

John Gottman

Cliff Notarius

Howard Markman

Gwendolyn Mettetal

AFFECT CODES

by

John Gottman

Cliff Notarius

Couples Interaction Scoring System (CISS): Context & Affect Codes

Coding Nonverbal Behavior During Message Delivery and Listening

John Gottman
Cliff Notarius

University of Illinois
Department of Psychology
Clinical Division
505 East Green Street
Champaign, Illinois 61820
(217) 333-0040

There are three nonverbal codes, positive (+), neutral (0), or negative (-). Affect codes during a thought unit code the speaker's nonverbal behavior, while context codes during a thought unit code the listener's nonverbal behavior. Only one affect code and one context code are assigned to any thought unit. Using both the transcript and the videotape, the coder scans down the list of cues for positive or negative nonverbal behavior in the *face*. If the coder is unable to make a positive or negative judgement, the list of *voice tone* cues then is scanned; if the coder is still unable to make a positive or negative judgement, the list of *body* (relaxation/tension or immediacy) cues. If the coder is still unable to make a positive or negative judgement, the unit is coded neutral. This hierarchical decision rule is suggested by a regression equation derived by Mehrabian (1972).

Later this codebook will present lists of cues the coders eventually scan for each channel (face, voice, and body). However, these cues are the end point of a training program designed to teach coders to become sensitive detectors of nonverbal behavior in each channel. For the face Ekman and Friesen's (1975) book is used as a text, and the exercises in the book on the brow, eye, and mouth area for six emotions (surprise, fear, disgust, anger, happiness, and sadness) are used to test coders' knowledge. A set of slides from Izard (1971) shown rapidly to coders is also used as a check of knowledge of the face. For the voice, coders must be able to decode (and also encode) a list of emotional cues in the alphabet being read (from Davitz and Davitz, 1959).

Coders must, however, become sensitive to the interaction and not expect exaggerated displays of nonverbal behavior. For example, brief slight smile is sufficient for a positive code. The concept of "affective climate" is helpful. It suggests viewing each nonverbal cue as it contributes to an overall affective atmosphere.

Coders encounter problems when they attempt to code the speakers' intention or internal state instead of attending solely to the cues displayed during message delivery. Coders are instructed to ignore the content of what is being said when coding each channel, particularly the voice. Although this is difficult, research with the voice indicates that with experience coders will attend primarily to vocal rather than verbal cues. Coders are also instructed to avoid negative or positive halo judgements. It is not necessarily a "bad" sign to have a high frequency of negative codes. Perhaps it just represents an ability to express one's feelings. Likewise, it is not necessarily a "good" sign to have a high frequency of positive codes. It may reflect an inability to confront negative feelings. The coder must avoid attributing significance to either positive or negative codes. The couple's behavior should be coded as objectively as possible and this can be accomplished best by sticking close to the cues specified in the manual.

<u>To the coder</u>

In coding nonverbal behavior the marital dyad will be best viewed by the coder as an interacting *system*. This system can be described along a positive to negative dimension at any particular time depending on the [illegible] behaviors of the couple.

[illegible]k of the interaction creating a sort of "climate" that i[illegible]m. Whenever the couple behaves so that a more [illegible]easant, climate is created, a positive (+) is coded; behaviors that create a more negative, or more unpleasant, climate are coded negative (-). Many behaviors will be neither positive nor negative and should be coded neutral (0). Positive or negative codes can be seen as a deviation away from the neutral center of an affect continuum.

In assigning a +, -, or 0 code, a number of specific cues will be used for each of these separate channels of nonverbal behavior, *the face*, *the voice* and *the body*. Each thought unit of transcript is coded for both the speaker's and the listener's nonverbal behavior. You may assign a +, -, or 0 code to facial, voice tone and body cues for both listener and speaker. You will assign only one code to each thought unit. You will have both the verbatim slashed transcript with numbered thought units and the videotape to use. Obviously, you will need both to record the nonverbal codes at the appropriate thought units, but we want you to ignore the content of what is being said in your coding. That's because we want a judgement of nonverbal behavior that is as pure as possible. Another coder will code content on each tape, so it would be redundant to code content twice. This will be hard to do unless you practice, and remember that we are not coding *what* they are saying but *how* they are saying it (or listening to it).

The codes you would assign separately to each channel will usually agree, but not always. We have selected a decision rule (based on the research of Albert Mehrabian) that the face takes precedence over the voice, which takes precedence over the body.

View the tape all the way through and note particular areas of what seem like non-neutral, nonverbal behavior in any of the three channels. Then go back over the tape again for coding. This first viewing and listening will help you adjust to the particular styles of both people. For example, some people's faces are not very expressive, and you have to look for smaller movements, and some people's speech is more nasal so that you will have to adjust your coding to each person's style as an individual.

You will be reading *Unmasking the Face*, so the section below is intended only as a brief review to supplement your own outline and summary of that book.

I. THE FACE

Study the table below (modified, but based on Izard, 1971, pp. 242-243) for specific behaviors of the face that are coded as positive or negative. Eventually you will be able to rely on the summary cue words at the end of this section and the summary sheet to jog your memory. Most facial expressions are blends of these nine emotions. You will have to look at the whole face to decide if the facial code is positive, negative or neutral.

Research by Ekman, Ellsworth and Friesen (1971) and Ekman, Friesen and Tomkins (1971) with Ekman's Facial Affect Scoring Technique (FAST) indicates that the lower face and the eye area are best for showing happiness; the eyes are most revealing for sadness; surprise is shown most in the eye area and lower face; anger is recognized most in the lower face and the brows-forehead area; disgust is most expressed in the lower face; fear is best identified in the eye area. However, in general, you will have to look at the whole face, *and consider the context*, for this coding.

The drawing below gives you some idea of how eye and mouth regions of the face produce different emotional displays and blends.

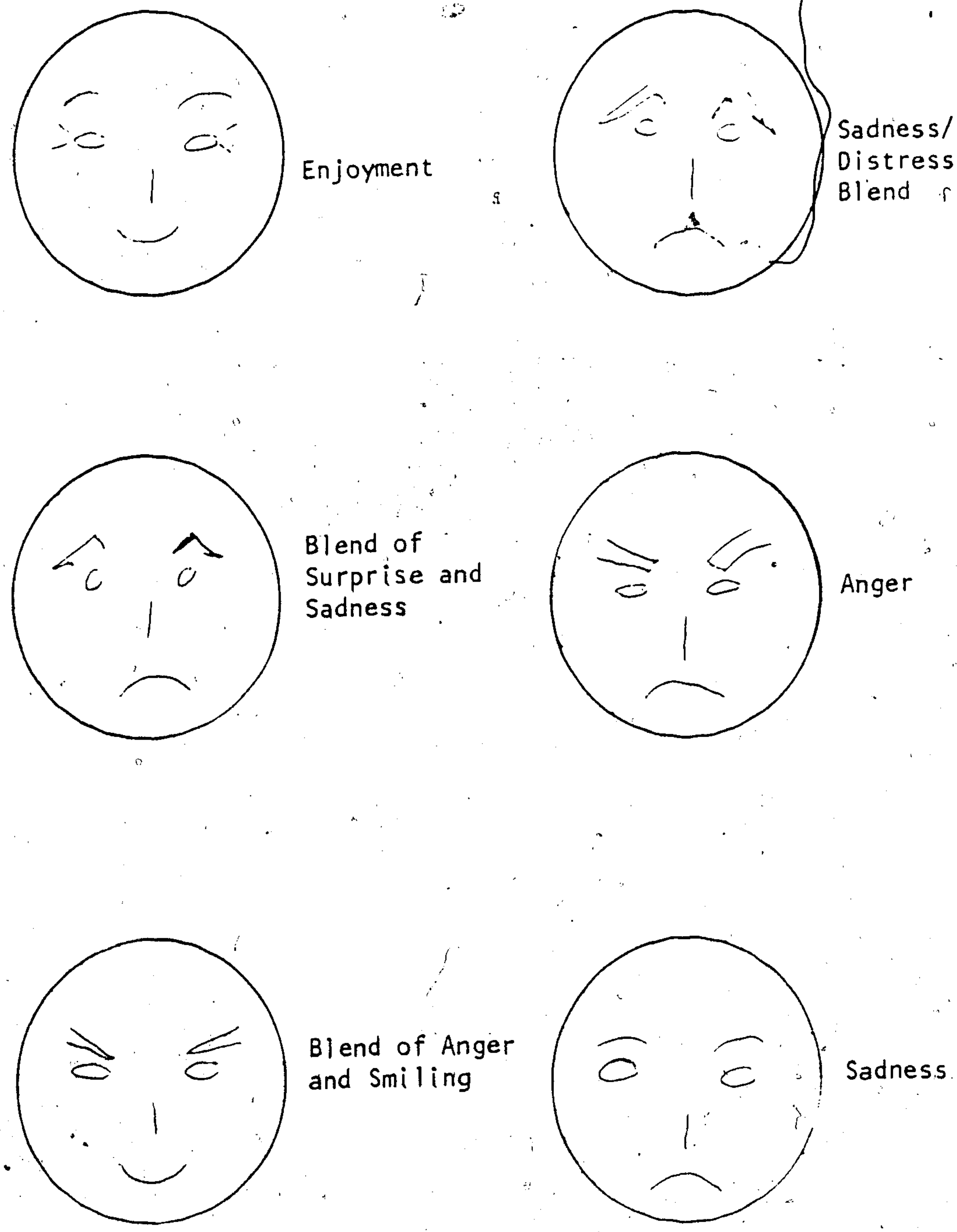


Figure 1. Eye and mouth regions of the face interact in producing different facial affective displays

Positive Face

Emotion	Feature	Position or Movement
Interest-excitement	Eyebrows	Slightly lifted or slightly lowered.
	Eyes	May be exaggeratedly opened and fixated. Lower eyelids may be raised as though to sharpen visual focus.
	Mouth	Lips may be parted; underjaw may be dropped slightly.
Enjoyment-joy	Eyebrows	Slightly lowered, forehead relatively smooth.
	Eyes	Bright, partially closed (more exaggerated in laughing). Wrinkles formed in outer corners.
	Mouth	Corners lifted. In smiling may be closed or slightly opened; in laughter corners pulled back and up. Teeth show; upper lip is tense. Nasolabial grooves appear.
	Cheeks	Raised, pushing up lower eyelid, making face seem shorter and broader.
	Nose	May appear to elongate and taper, or nose wrinkles may appear.
Responsiveness	Whole Face	Concerned, emphathic face.
	Head	Head nod.
	Eyes	Eye contact (if held too long, it is a glare and negative).

Negative Face

Emotion	Feature	Position or Movement
Distress-anguish	Eyebrows and Forehead	Muscles contracted, pulling eyebrows together. Inner corners may be raised or lowered slightly. Vertical wrinkles appear between inner corners.
	Eyes	Eyelids contracted, eyes being partially closed.
	Mouth	Corners drawn in and turned down. Tense; center of lower lip pushed upward; furrow from nose to mouth formed.
Anger-rage	Eyebrows	Drawn together and down, causing vertical wrinkles between.
	Eyes	Opened wide, fixated. May become reddened, pupils contracted.
	Mouth	Teeth usually clenched tightly. Rigidity of lips and jaw. Lips may be tightly compressed or may be drawn back to expose teeth.
	Nose	Nostrils distended.
	Neck	Muscles strained and rigid.
Shame-humiliation	Forehead	May be wrinkled vertically or transversely.
	Eyebrows	Inner corners may be drawn down.
	Eyes	Lowered or glancing.
	Mouth	Lips drawn in, corners depressed. Lower lip may either protrude slightly or be tucked between teeth.
	Head	Lowered
Fear-terror	Forehead	Wrinkled transversely.
	Eyebrows	Raised.
	Eyes	Widely open, staring. Pupils dilated.
	Mouth	Open, rigid. Corners drawn back and depressed.
	Cheeks	Lower parts drawn down and back, due to action of mouth.

	Nose	Nostrils flared.
Unresponsive	Whole Face	Distinct look of boredom, apathy, unresponsiveness. May blend into disgust/revulsion.
Contempt-scorn	Eyebrows	One may be raised slightly higher than the other.
	Eyes	Somewhat narrowed. Glare, or prolonged eye contact may fit in here.
	Mouth	Corners depressed. Lower lip raised, slightly protruding. One side of upper lip may be raised in a sneer.
	Cheeks	Drawn down by movement of mouth.
	Head	May be thrown back.
	Nose	Nostrils may be flared outward.
Disgust-revulsion	Eyebrows	May be slightly lowered.
	Eyes	May be partially closed, result of nose being drawn upward.
	Mouth	Upper lip raised. Corners drawn down and back; tongue moved forward, may be slightly protruding.
	Nose	Drawn up, wrinkled.

Surprise could be considered positive, negative or neutral *depending on the context* or the behavior's effect on the climate of interaction.

Surprise-startle	Eyebrows	May be raised (with open eyes) or lowered slightly.
	Eyes	May be either wide open and rounded or blinking.
	Mouth	Usually open and rounded to form an "O."
	Forehead	Muscles horizontally contracted, creating transverse wrinkles.
	Jaw	Slack; muscles of lower face elongated.

You should think of these tables as a guide; they were collated from many sources by Izard's (1971) book and there has been a great deal of work on the face since 1971. In our training program we will be looking at a large number of slides from Izard and Ekman's work that contain pure emotional displays and blends of emotions. Eventually you will become more confident at reading faces, and you will find the list of cue words below helpful:

Positive Face	Negative Face	
smile	frown	glare
laugh	sneer	shame
empathic face	fear face	distress
head nod	cry	worry
eye contact	mocking laugh	boredom
joy	smirk	contempt
interest	angry face	scorn
	disgust	

Judgements have to be made depending on the context. For example, an eye contact held too long could be a glare.

II. THE VOICE

The voice contributes a great deal to displays of emotion. The table below is a compilation of some specific positive cues (Knapp, 1972).

Positive Voice

Feeling	Loudness	Pitch	Timbre	Rate	Inflection	Rhythm	Enunciation
Affection	Soft	Low	Resonant	Slow	Steady and slight upward	Regular	Slurred
Satisfaction	Normal	Normal	Somewhat normal resonant		Slight upward	Regular	Somewhat slurred
Cheerfulness	Moderately high	Moderately high	Moderately blaring	Moderately fast	Up and down; overall upward	Regular	
Joy	Loud	High	Moderately blaring	Fast	Upward	Regular	

The table below is a compilation (from the same source) of some specific negative cues.

Negative Voice

Feeling	Loudness	Pitch	Timbre	Rate	Inflection	Rhythm	Enunciation
Boredom	Moderate to low	Moderate to low	Moderately resonant	Moderately slow	Monotone	---	Somewhat slurred
Impatience	Normal	Normal to moderately high	Moderately blaring	Moderately fast	Slight upward	---	Somewhat clipped
Anger	Loud	High	Blaring	Fast	Irregular up & down	Irregular	Clipped
Sadness	Soft	Low	Resonant	Slow	Downward	Irregular pauses	Slurred

These two tables are certainly limited in describing the incredible expressiveness in the voice. Certainly all the emotions we mentioned for the face--interest/excitement, enjoyment/joy, responsiveness, distress/anguish, anger/rage, shame/humiliation, fear/terror, unresponsiveness, boredom, contempt/scorn, disgust/revulsion and surprise/startle can be expressed in the voice.

The tapes we will listen to in decoding and make in encoding these emotions and blends will help you in coding the vocal channel. Here are some summary key words that may be useful later in cuing your memory while coding.

Positive Voice		Negative Voice	
caring	loving	cold	blaring
warm	satisfied	tense	sarcastic
soft	buoyant	scared	angry
tender	bubbly	impatient	furious
relieved	cheerful	hard	blaring
empathic	chuckling	clipped	hurt
concerned	laugh	staccato	depressed
affectionate	happy	whining	accusing

Speech Disturbances

Speech disturbances have been studied (see review of literature in Knapp, 1972) and two kinds have been distinguished. One kind, called "ah disturbances," is neutral. Words like "ah," "er," "um" are designed to provide the speaker with thinking time; they are a vehicle for keeping the floor. The other kind, called "non-ah-disturbances," are coded as negative voice. They are:

sentence change in middle of a sentence
repetition in mid-sentence
stuttering
omissions, slips
intruding incoherent sound

and are generally indicative of tension. The table below gives examples of categories of speech disturbances (from Cook, 1969) and about how often you can expect them to occur. A non-ah-disturbance of speech during a thought unit would be coded negative. Ah-disturbances are coded neutral.

Category	Frequency %	Example
1. "Er," "Ah," or "um"	40.5	Well . . . er . . . when I go home . . .
2. Sentence change	25.3	I have a book which . . . the book I need for finals . . .
3. Repetition	19.2	I often . . . often work at night.
4. Stutter	7.8	It sort of l . . . l . . . leaves me.
5. Omission (i.e., leaving out a word or leaving it unfinished)	4.5	I went to the lib . . . the Bod.
6. Sentence incompletion	1.2	He said the reason was . . . anyway, he couldn't go.
7. Tongue slip	0.7	I haven't much term (i.e., time) these days.
8. Incoherent intruding sound	1.2	I don't really know why . . . dh . . . I went.

III. THE BODY

Body cues are not as clear as indicators of affective display, but we will code them anyway. Use the table below for positive and negative body.

Positive Body	Negative Body
Neck relaxation	Neck tension
Hand relaxation	Hand tension
Touching	Distance increase
Distance reduction between speaker and listener (for example, forward lean or moving chair closer)	Rejection of contact (or attempted contact)
	Symmetrical limb placement
Asymmetrical limb placement	Stiff posture
Sideways lean	Arms akimbo
Open arms	Throws up hands in disgust
Shakes whole body in agreement	Shakes whole body in disagreement

Remember that it is important to be sensitive to the interaction taking place. A behavior need not occur in the extreme to be coded. A brief smile is sufficient for a positive face code since it adds to a positive climate. Rollicking laughter is not necessary for a positive voice code. It is also important to code nonverbal behavior not in terms of how you think the behavior was intended, or in terms of how it was taken by the spouse. Stick as closely as you can to the cues in this manual. For example, a sarcastic voice will receive a negative voice code no matter how it is received. Our intention here is to describe as accurately as we can.

COUPLES INTERACTION SCORING SYSTEM--CONTENT (CISS)*

John Gottman
Cliff Notarius
Howard Markman
Gwendolyn Mettetal

University of Illinois

Department of Psychology

505 E. Green Street

Champaign, Illinois 61820

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Revision

*pronounced "kiss"

AG - AGREEMENT

Although agreement may seem like a simple matter, there are a number of subcodes that all get coded agreement. We want you to learn these subcodes even though you will be coding all of them AG, for agreement.

Type I: Direct agreement (DA) This type of agreement is a statement of direct acknowledgement of agreement with the other person's views.

- a You're right.
- b OK
- c I think that was very well put.
- d It is certainly true that our lives could be affected by these global sorts of things.

Direct agreement requires some preceding point of view to be expressed with which the speaker agrees.

W: I think we have a problem with the kids.

H: Yeah. (AG) (I agree)

Note that this type of agreement is different from a request for information. Consider this example:

W: Do you think we have a problem with the kids?

H: Yeah. (We do have a problem)

This is a response to a request for information, not agreement.

Type II. Accepts responsibility (AR) for a past or present problem. The question of responsibility will usually be raised in a preceding statement of a problem or criticism from the other. Statements fitting this type of AG may assume several different forms.

1. Statement in which a person admits engaging in a behavior which has been defined as a problem by the other.

   a. You're right. I *have* been putting wet towels in the hamper.
   b. I haven't been doing my share, I agree.

2. Statements in which one person suggests that both partners are responsible for a problem.

   a. I guess we've both been neglecting the kids.
   b. Yes, I suppose we need to budget our time better.

3. Any apologetic statement.

   a. I'm sorry for the way I acted.
   b. I really feel bad that I hurt you.

4. When one spouse criticizes the other, and the other accepts the criticism.

   a. W: John, you're so messy. You've got books and papers all over the place.

      H: Yeah, you're right.

Note: When the speaker recognizes that he/she *ought* to accept more responsibility (but doesn't actually accept it), it is *not* coded AG.

   a. I really feel I ought to be doing more to help you around the house.

Type III. Accepts Modification (AM)

Accepting modification is a change of opinion as a result of influence from the other person. The speaker must have previously stated an opinion and then changed as a function of his/her spouse's opinions or arguments.

> OK, you're right, I'm wrong.
>
> I never saw it that way before, Bill; the kids can take care of themselves while we're at the movies.
>
> Yeah, you're right. I see now how curiosity can get you in trouble.

Type IV. Compliance (CP)

Compliance is coded when a person's response (verbal or nonverbal) fulfills the requirements of an immediately preceding command or clarification request. Either compliance or noncompliance *must* be coded after every command or clarification request. CP is double coded along with the appropriate code for the complying behavior.

W: I'm doing too much housework.

H: Stop smoking! (command)

W: I'm doing more than my share, that's all. (noncompliance)

Note: Agreeing with a request for delayed compliance is also compliance.

EXAMPLES:

W: Pick up some bread when you go to the store. (command)

H: OK, I will. (compliance)

Type V. Assent

An assent is a brief verbal response (such as "Yeah," "Mmhmm") while the other person is talking, that acknowledges listening or attention rather than indicating explicit agreement. Repetition of the other's statements in a neutral tone of voice is also an assent.

DG - DISAGREEMENT

There are several kinds of disagreement. We will describe each type of disagreement, although each is coded DG.

Type I. Direct disagreement (DD) is a simple disagreement with a spouse's viewpoint or a denial of responsibility for a past or a present problem.

Simple disagreement

a. No, it's never been twice a week.

b. No, I don't think we agreed to that.

c. I don't really think that would be a good idea.

At the beginning of a conversation there may be an exchange of information and opinions. This is not disagreement; it is simply an exchange of opinion.

W: I like to dress up and go out.

H: I prefer quiet evenings at home.

However, if the husband had said "I disagree, quiet evenings at home are much nicer," the statement would be coded DG. The key to picking up disagreements is to look for contradictory statements.

H: You talked to Bob Smith a long time last night.

W: I didn't talk to Bob.

Denial of responsibility. When a question of responsibility for a past or present problem arises, a person may explicitly deny that he/she is responsible or should be responsible for the situation. The question of responsibility will usually be raised in a preceding statement of a problem response criticizing the other partner.

a. You didn't clean the cat box.
   Well, I never said I would. (DG)

b. You never pick up my clothes at the cleaners.
   Yes I do. (DG)

Also, any statement in which one person suggests that neither partner is responsible for a particular problem is coded DG.

Perhaps we're both at fault.

No, we had nothing to do with the problem. (DG)

<u>Type II. Yes But</u> (YB), is a statement of qualified agreement or apology which can be explicit or implicit.

EXAMPLES:

I'm sorry I made you mad but I really felt that I had to make my point.

There is nothing upsetting me.
Yeah, but it sure seems like there is.
OK, but it sure seems like there is.
Well, but it sure seems like there is.

Yes, but we do have to spend money sometimes.
OK, you're right; however, that situation will never arise.

H: I think we spend too much time doing housework.

W: I agree, honey, but the work must be done.

Yes but statements are coded DG, and the "but" section is double-coded with the appropriate code.

<u>Type III. Disagreement with rationale supplied</u> (RA)

When the speaker provides a rationale, justification, reason or explanation for his/her disagreement, the statement is coded DG. The DG is double-coded with the appropriate code for the rationale.

EXAMPLES:

No, we have to go see Mom. She really appreciates our visits. (DG)
I'd like to disagree with that statement; I don't think I've ever done that, I really don't believe in that. (DG)
You're wrong; it's important to save money in case of an emergency.

Type IV. Command (CM)

A statement telling or ordering the partner to do something or not to do something is coded DG.

EXAMPLES:

Listen to me.
Let me do that.
Shut up.
Put down number three.
Stop doing that.

Whenever a command makes an immediate demand, the coder must indicate whether the request is honored by coding either compliance (CP) or non-compliance (NC) in the subsequent behavior of the other person. The response may be nonverbal as well as verbal.

Type V. Noncompliance (NC) is a failure to fulfill requirements of an immediately preceding command or clarification request. NC is double-coded along with the appropriate code for the noncomplying behavior.

EXAMPLES:

W: I'm working too hard.

H: Say that again.

W: You're not listening to me. Every night you come home and sit down in front of the TV . . . (noncompliance)

W: Pick up some bread when you go to the store.

H: I can't; I don't have enough money. (noncompliance)

All these types of disagreement are coded DG.

CURRICULUM VITA

NAME: James M. White

ADDRESS: #305, 103 - 11A St. N.W.
Calgary, Alberta
T2N 1X9

TELEPHONE: Residence: (403) 283-9221 Office: 284-6501

CITIZENSHIP: Canadian Citizen: U.S. Visa

DATE OF BIRTH: February 22, 1946

EDUCATION: Ph.D., Sociology, The University of Alberta
Edmonton, Alberta, 1980

Thesis Title: "A Model of Interpersonal Perception and Communication in the Dyad"

Thesis Committee: Lyle Larson, Supervisor; Mike Gillespie; Charles Hobart; Richard Jung; John Peters; and Jason Montgomery

Areas of Specialization:
- Sociology of the Family
- Social Psychology
- Theory Construction
- Communication Theory

M.A., Sociology, The University of Calgary, Calgary Alberta, 1974

Thesis Title: "Racism and Race Prejudice: A Real Distinction"

Thesis Committee: Joe DiSanto, Supervisor; James Frideres; Vern Serl

Areas of Specialization:
- Race Relations
- Social Psychology
- Sociological Theory
- Research Methods

B.A., Sociology, Colorado College, Colorado Springs Colorado, 1968

AWARDS: Canada Council Doctoral Fellowship, 1977-1979
Carleton Scholarship, Carleton University, Ottawa, 1975
Teaching Assistantship, Carleton University, Ottawa, 1975
Teaching Assistantship, University of Calgary, 1970-1973
Academic Bursary, University of Calgary, 1971
Nominee, Harvard Educational Fellowship, 1968

RESEARCH AND WORK EXPERIENCE:

Graduate Research Assistant, Sociology, 1976-1977

University of Alberta, Edmonton, Alberta
Dr. T. White and Dr. J. Gartrell

Consultant, Canpac and Calgary Power (subcontracted by Montreal Engineering), 1976

Environmental Impact Studies, Calgary, Alberta

Field Director, the Family and Work Research Project, 1975

Department of Sociology, University of Calgary
Calgary, Alberta (supervised staff of 25)
Dr. M. Brinkerhoff

Research Director, YWCA School Project, 1974-1975

Department of Culture, Youth and Recreation
J. J. Bowlen Bldg., Calgary, Alberta
Ms. Beth Bryant

Research Director and Activities Coordinator, YWCA School Project, 1973-1974

Department of Culture, Youth and Recreation
J. J. Bowlen Bldg., Calgary, Alberta

Team Leader and Child Care Worker, 1969-1970

William Roper Hull Home
Anderson Rd. S.W., Calgary, Alberta
Gerald Fewster, Director

TEACHING EXPERIENCE:

Mount Royal College
University of Calgary
University of Alberta

PAPERS AND PUBLICATIONS:

1. "Evaluation of the Y.W.C.A. School Project." A report to the Department of Culture, Youth and Recreation, Government of Alberta 1975 and 1976.

2. "Status Assessment among Recreationalists: A Competition-Conflict Model" presented to Department Colloquia, Department of Sociology University of Calgary, 1976, 10 pp.

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JMW/mjp