A Systems Approach to Complex Social Behavior: The Formulation of a Methodology and Its Application to the Peasant Village of Tzintzuntzan

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A SYSTEMS APPROACH TO COMPLEX SOCIAL BEHAVIOR:
THE FORMULATION OF A METHODOLOGY AND ITS
APPLICATION TO THE PEASANT VILLAGE OF TZINTZUNTZAN

by

William Earl Reynolds

A Thesis
Submitted to the
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William Earl Reynolds
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INTRODUCTION

The following thesis is a formulation of a theory and methodology whereby social scientists may deal with complex human behavior. The methodology is an operationalization of General Systems Theory and the systems philosophy, both of which have provided the parameters within which this thesis has been written. General Systems Theory enables the development of methods to facilitate the planning of change in a humane manner that are applicable to any socio-cultural level of human organization. In a very general sense systems theory provides for the study of the whole of a given system through time via the system's internal and external interrelations (See Laszlo 1972 for a general discussion of the systems philosophy).

Systems are any perceivable organization of meaning from the information sea which surrounds us. A system decreases the information level and increases the level of redundancy or meaning. As information is defined in terms of "bits" (Tribus and McIrvine 1971:18) organization that relates "bits" decreases their autonomy and increases their redundancy or relational property.
With this conception of a system, culture is an organization that selects certain "bits" and relates them in a meaningful manner to a given group of people. The fact that we are hominids puts certain constraints on our input receiving mechanisms and thus many aspects of different cultures are similar. Yet each culture is different in that it selects specific bits of information, given its environment and level of socio-cultural development. This is the essence behind cultural relativism, that different "bits" are organized and result in various perceptions of the world or information sea. The role of social science is to develop a means of comparing various existent organizations in light of cultural/world systems goals and modifying these organizations to enable the achievement of specific goals. This thesis is an attempt to present a method of comparing existing organizations and a model of planned change for the example discussed.

The theoretical framework we are advocating for social science is constructed upon the following nine assumptions:

1. Change occurs all the time in all things
   and at all levels of abstraction, to a greater or lesser degree relative to the intensity of information/energy flow.

2. There are no "nautral" divisions of the real world (cf. Laszlo 1972:16). Theoretically it is pure information of an infinite variety.
3. Any division of the "real" world is based on decisions that are culturally defined which facilitate perceptions and organizations to enable the people to deal with the "real" world. (cf. Bertalanffy 1972:XX)

4. The environment consists of inputs which influence the system. The system is not totally conscious of all the inputs yet is receptive to them.

5. Change is due to mutual-causal interrelations of information/energy.


7. Human behavior is the result of complex mutual causal interrelations of information/energy with a defined environment.

8. Human systems seek more mutual adaptive relationships to the environment and a change in either affects the other.

9. Human relationships may be characterized as complex adaptive behaviors (Buckley 1968).

This effort is divided into two sections, the first discussing the theory and method of dealing with complex systems and the second, applying the theory and method to a specific example.
The Mexican peasant village of Tzintzuntzan, studied by George M. Foster, was chosen because Foster's extensive publications provided a rich data base from which to work, and Foster has examined it through a well known model which can be contrasted with my own. The primary purpose of discussing Foster's work is to demonstrate that the systems approach enables the criteria of explanation (logic predictions and control; see page 27 of this thesis) to become more powerful. It is not that Foster's model is wrong, but that our model supersedes it.

The first sub-section of part one is a discussion of the concept of change as defined in structural-functionalism and systems theory. The second sub-section is a comparison of the classificational and relational universes. It lays a foundation for the rest of the thesis. The third sub-section discusses our definition of explanation. The definition is framed in terms of the goals of social science, the integration of the pattern and deductive models (the P-D model), and the "openness" of explanations. Sub-section four deals with the structure of the P-D model. It discusses the operationalization of the P-D model through problem perception, construction of a system, the deductive testing of the proposed system, and the evaluation of explanations. The fifth sub-section delves more deeply into the evaluation of explanations, the explanations logic, its degree of prediction, and the amount of control it provides. The sixth and
final sub-section of part one presents a way of organizing and perceiving the empirical world in terms of systems, the systems constituent parts, the systems interrelations and how change occurs.

The first sub-section of part two discusses Foster's explanatory model for Tzintzuntzan, the Image of Limited Good. The second sub-section discusses how the nodes and feedback channels of my systems model of Tzintzuntzan were defined in terms of the general system. The third sub-section discusses specific examples of how the P-D model is used to test the model of Tzintzuntzan. Various types of questions that may be asked of the model are demonstrated. The final sub-section, number four, is a comparison of Foster's Limited Good model and the systems model in terms of their logic, prediction and control.
THE BASIS FOR SYSTEMS THEORY

Systems Theory and Structural-Functionalism

The emphasis of change through time is a distinguishing factor between our systems approach and the structural-functional approach; more specifically, our concern is with not only change through time, but the kind of change. In structural-functionalism change is seen as the alteration of structures and functions from one equilibrium to another equilibrium (Allen 1971:77). In our systems approach, we view change in a steady state system, one where the structure is changing but the system is still considered an organization of non-random variables; there is not movement from one equilibrium point to another because structural change is always occurring (Buckley 1967:13).

From a structural-functional perspective it is possible to define an equilibrium point because change is considered to have a beginning and an ending and is not viewed as being a continuous interaction of mutually-causal variables. Equilibrium points are more specifically defined by variables the social scientist deems as functional requisites or ones that have to be in existence for a system to be viable. If any one of the functional requisites is modified to the extent that it disrupts the system, the equilibrium is not sustainable and the system either establishes
a new equilibrium or is destroyed. (cf. Cancian's discussion of two types of variables, G's and state coordinates in which she notes that "G is the property of the system that is maintained or is stable. Stable coordinates determine the presence or absence of G" (1968:205)).

As structural-functional theory emphasis changes from one equilibrium point to another, it is logical that it also stresses the factors that promote the equilibrium state. Allport (1968:28) writes that "functional theories stress maintenance of present directions allowing little room or not at all for departure and change." Young (1968:28) writing from the perspective of a political scientist also believes that the primary concern of structural-functionalism is with systems maintenance and regulation. Structural-functionalism centers around the concept of functional requisites which entail the maintenance of specific essential characteristics of the system within the bounds of recognizability, i.e. there is a finite set of arrangements which much be met if the system is to remain viable. These are essentially static and include (1) latent pattern maintenance and tension management, (2) goal attainment, (3) adaptation, and (4) integration (Allen 1971:77). Because structural-functionalism emphasizes system "needs", it cannot deal with the concept of system purpose and goal-seeking. Structural-functionalism deals with the question of "what structures fulfill what basic functions
and under what conditions in any given system?" (Young 1968:28).

Because structural-functionalism focuses on a static

equilibrium state, it cannot handle causal priority of some

system networks over others; hierarchies based on modifications

in the intensity and kind of information/energy flow in given

variables which constitute system networks. It cannot deal

with problems of development and change.

"This model (structural-functionalism) therefore,

lends only to a consideration of adjutive pro-
cesses and deviance control aimed at adaption of
the acts to a given dominant structure and does
not provide for mechanisms that adapt or change
the system structure to accommodate the act or
maintain the total system. Social change, it is
said, is also residual . . . since it implies
that the sources of change are always external
to the system" (Buckley 1967:29).

We consider structural-functionalism as the product of a

classificational universe for it asks a mutually exclusive

question: is the system in equilibrium or not? In our perspec-
tive of real world systems, the process of mutual-causal inter-
action of variables, the question of equilibrium is inappropriate

and contradictory. We are concerned with how things relate given

various intensities of information/energy flow, not whether they

are in equilibrium or between states of equilibrium.

Systems theory handles change and purposeful behavior through

the concept of feedback. It is axiomatic that change is occurring

all the time in real world systems based on intensities of informa-
tion/energy. In humans, change is the result of a stimulus that
has been mapped into the cognitive organization of the stimulus receiver. If this definition is acceptable, then the question as to whether the change is the result of internal or external stimuli is academic. In real world systems, there are no boundaries unless a level of abstraction is specified. The systems theorist conceives of change as the result of internal and external sources of influences based on the problem he is dealing with. The distinction is of importance only when one is regulating change and whether the receivers perceive it as internal or external.

Mutual-causal priority is established in that given the information/energy input, certain relations occur before others. It is axiomatic that 'causes' are mutual in that information inputs are too many variables that combine to produce a response or responses that feedback to the originating variable. Through feedback then, structural strains or deviant patterns are seen as part of the whole pattern of interaction and not something that disrupts an equilibrium state.

The Classificational and Relational Universes

The perspective of this thesis is that our universe is relational or event-oriented and not classificational or substance-oriented (Maruyama 1966:55-60; Laszlo 1972:Chapter 3). Presently, the classificational universe prevails in the Greek-Roman-American
traditions. This universe is characterized as:

1. Being persistent in time.
2. Obeying the laws of identity and mutual exclusiveness.
3. Having substances (physical/abstract) that are classifiable into mutually exclusive categories.
4. Having categories that may be divided into subcategories or combined into supercategories.
5. Having a category which includes all other categories and is called the universe.

(Maruyama 1966:55).

The structure of this universe is hierarchical, consisting of superdivisions and subdivisions which have static interrelations.

The classificational universe has an ontological or causal priority among its entities. At any given moment only one stimulus is conceived of as acting upon phenomena. Only through time may more than one stimulus be conceived of and discerned. The reason is that phenomena are classified into discrete and separate categories. If more than one stimulus were to occur simultaneously, it would be impossible to classify the entity, for the question then would be: with which stimulus should the entity be classified? The stimuli are separate and distinct, so the effect
of each on the entity will be separate and distinct. The entity is now in conflict with itself as that which was a whole is now divided into simultaneously exclusive parts; either part cannot be classified and remain a logical or a noncontradictory whole. If carried to its logical conclusion, this orientation would result in an inverse pyramiding to an infinite extent as every modification of a phenomena would produce a discrete and separate situation having no connection with preceding phenomena via a processual mutually-interactive continuum.

The solution to this organizational quandary is the establishment of causal priorities. This is operationalized by the division of a temporal situation into increasingly shorter units of elapsed time. In this manner, it is possible to stipulate which stimulus occurred first, determine its effect, and proceed to the next stimulus in cause-effect progression, thus permitting discrete, separate categories to exist (cf. Toda and Shuford Jr. (1965), esp. p. 8).

We believe however, that an alternative to the classificational universe exists as designated by Maruyama (1966), i.e. the relational universe. The relational universe conceives the empirical world as a processual, mutually interactive continuum, a view we propose to demonstrate as more powerful and pervasive in terms of explanation. In the relational universe, the simultaneous mutuality of interactions and causality predominates as opposed to the ontological or causal priority among phenomena in the classificational
Categories in the relational universe are established utilizing different criteria. Primarily, a given category is not considered separate and distinct, but much less deterministic and more flexible in that the parameters of the category are not as absolute as parameters in the classificational universe. In the relational universe categories are determined by the problem under investigation.

"Its (relational universe) focus is on mutual causality. It is interested in the nature of mutual links between elements rather than in the nature of the element in itself. No element has a causal priority upon others but is an indispensible element in the chain circle of causality. . . (this is) the basic cosmology behind the 'Second Cyberntics'" (Maruyama 1966:58).

The question is not "What is it/" but "How does it relate to others?" Thus the relations are mutual, situational, many-sided, and not subordinational, superordinational or paraordinational.

There are no established permanent hierarchies in the relational universe.

The classificational universe aims at knowledge about things via increasing the power of discrimination and classification. Relations are unidirectional cause and effect with the individual "things" conceived in terms of contrasts. In the relational universe, the aim is to gain understanding regarding relationships; for the social scientists human relationships in the context of social and physical environments. The relations are not
unidirectional cause and effect but mutual. The individual is not perceived in contrasts but in his relations with others (cf. Bertalanffy 1972:XVIII). "(Basically), definition is not given by categories and subcategories, but by interactions and interrelations" (Maruyama 1966:58).
THE DEFINITION OF EXPLANATION

Our basis for a definition of explanation is the belief that social science has two general goals, first, to develop methods by which human behavior, past and present, may be understood for the purpose of solving socio-cultural problems. Current problems and their solutions shape future events; therefore the anticipation of future events is critical in helping to determine which of the solutions to current problems most facilitates the accomplishment of given goals. Secondly, we have to develop control over increasingly complex social behaviors. If we assume that modification of human behavior is not valid for ethical or operational reasons, then Meadows (1972) "Limits to Growth" is in fact a doomsday forecast. If, however, we believe that human behavior can be deliberately modified in a humane manner, then the Meadows last world simulation is an attainable goal worth striving for. For this reason, the theories and methods which potentially provide humanistic control are worth considering in detail (Meehan 1968). The use of this definition will be such that we may determine how future events may be controlled and ways which in principle, we might intervene. We have characterized human social processes as non-equiliberating, complex adaptive behavior. To study and understand these processes, the
definition of explanation requires the examination of mutual causal interrelations. This involves the ability to give reasons which function to make phenomena intelligible and comprehensible. The method consists of the examination of facts with laws to form patterned relations which explicate the processes or events as applied to empirical situations. Explanation then is a "way of organizing human experience to show how or why events occur by linking those events to other events according to stipulated rules (laws)" (Meehan 1968:24).

To accomplish this type of explanation, we will utilize a combination of the pattern model (Meehan 1968) and the deductive model of explanation (both models in Kaplan 1964). The pattern model enables us to know the reason or explanation for phenomena when we can fit it into a known pattern. The deductive model provides an explanation when we deduce a phenomenon from postulated laws and antecedent conditions. The two models can be used separately or together for explanatory purposes. From the nature of the entire pattern and some of its parts we may deduce the other unknown portions and conversely, deductive relationships may be viewed as a cognitive pattern. Kaplan writes that when using the pattern model, something is explained when it is so related to a set of other elements that together they constitute a unified system (1964:333; see Meehan 1968, Chapter 3, "The Structure of Explanation"). Utilizing the pattern model, we have an explanation
for something when we understand it. The task of explanation is to create a suitable pattern. This is the basis for much of this thesis and will be discussed in more detail in the next section, "The Structure of the Paradigm".

Explanation via the deductive model occurs when particular instances are deducible from premises which include: 1) something which serves to distinguish the given particular in question and 2) general principles or postulated laws. The premises alone are not explanatory, but what is explained is logically deducible. In other words, from what we know about a given situation, the result could not have been otherwise; the element of necessity is the explanation. Kaplan (1964:339) points out that the "necessity" does not lie in the premises, but rather in the relation between the premises and the conclusion which they entail. It is important to note that the general principle need not be a causal law; what is required is logical or relational necessity, not causal necessity. The possibility exists that in social science, logical necessity may be too constraining. When dealing with certain premises, phenomena to be explained may only be very likely deducible, requiring more flexibility than strict logic provides. The reason is that explanations are always open (Hemple 1969, Hansen 1969, Scriven 1969).

The interaction of two laws does not constitute an explanation for either of them although each may be deduced from the relation-
ship. The laws have to be embedded in a more encompassing
pattern, the theory. A theory is not an extensional genera-
lization of its constituent laws (the whole being equal to the
sum of its parts) but a generalization of a higher level (the
whole being greater than the sum of its parts).

"The law itself, rather than its instances, is
shown to be a special case of a more general
phenomenon. It is on this basis that models
can make manifest the explanatory power of
theories" (Kaplan 1964:343).

A theory explains because it constitutes a more comprehen-
sive pattern consisting of all the laws and their interactions,
not by just permitting deductions based on laws. By allowing
the diverse phenomena (patterns of laws) to be fit into the more
comprehensive pattern, the theory provides understanding. As
the theory consists of mutual causal relationships, a further
result is that the patterns constituted by the various laws do
not form a static hierarchical arrangement among themselves. The
theory facilitates control and anticipation of phenomena because,
being patterned, the mutual causal interrelations may be modified
at will by the social scientist before ever applying it to the
empirical world.

In conclusion, we agree with Kaplan (1964:351-355) that ex-
planations are "open". Specifically, Kaplan believes that:

1. Explanations are partial: only some of the factors
determining the phenomenon being explained are being
taken into account.
2. Explanations are conditional: they apply to only a certain range of phenomena only when certain conditions are satisfied.

3. Explanations are approximate: the parameters they define are more or less inexact, the qualities they ascribe are a shade different from what is observed.

4. Explanations are indeterminate in their application to particular instances: they are statistical in content if not in explicit form, and may be true generally speaking but not in every single case.

5. Explanations are inconclusive: they do not show why what is being explained must be so, but why it was very likely that it would be so.

6. Explanations are uncertain: the laws and theories invoked, as well as the data applying to the particular case, are confirmed only to some degree.

7. Explanations are intermediate: every explanation is in turn subject to being explained.

8. Explanations are limited: they are appropriate to particular contexts in which they serve as explanations, not to every circumstance of inquiry.
THE STRUCTURE OF THE PARADIGM

This section focuses on the integration of the pattern and deductive models of explanation. As the pattern model is very similar to Meehan's system paradigm, our discussion will consider pattern and system synonymous unless otherwise noted.

The purpose of combining the pattern and deductive models is that we believe their integration will increase their explanatory power. To evaluate singularly the pattern model, one has to compare the model to an empirical situation and judge the degree of isomorphism; this does not involve use of the deductive model. When one has a complex pattern model of five or more variables, problems may occur. It is very difficult to keep the interrelationships in mind when evaluating the degree of isomorphism as one's degree of comprehension and organization is strained. Contrariwise, the deductive model requires that logic be the prime evaluative mechanism for any explanation. Again, only a limited number of variables can be meaningfully handled utilizing the deductive model because an explicit pattern is not presented. Because of the individual and separate limitations, the juncture of the two models should provide explanations of complex patterns whose constituent laws may be deductively tested.
To accomplish this goal, we have created the Pattern-Deductive Model (P-D model). To operationalize the P-D model, we will discuss 1) the perception of a problem, 2) the construction of a formal calculus, 3) the deductive tests, and 4) the evaluation of the P-D model.

We have adopted Meehan's meaning of knowledge for he conceives of knowledge as something "useful to man in his efforts to adapt himself to the environment and modify the environment for his own purposes" (1968:15). The quest for knowledge occurs when we perceive a pattern which we wish to understand. We conceptualize this as an open pattern for we cannot explicitly delineate any specific variables, their relations with each other, or their boundaries. At this point we are trying to formulate a conceptual organization of the pattern to use as a base for further elaboration. As we do not explicitly know the parameters of the pattern, we may include some variables that are not influential to the pattern and conversely, we may at first leave some important variables out. The point is that we have an open mind about the situation but concurrently we are trying to organize variables into a comprehensible system.

To describe this pattern and its variables we utilize two basic concepts. The first, **classificational** (Meehan 1968:39), is where we organize perceptions into variables and define their properties. (See Appendix I as an example). This operation is
not governed by the rigid criteria of the classificational universe discussed earlier because of the second concept, the description of relational properties (see Appendix II for example). Relational properties 1) connect classifications or relate them, 2) record simultaneous or successive variations in sets of classifications, or 3) record variations in the values of individual variables (Meehan 1968:39). To accomplish our definition of explanation we have to make a distinction between descriptions that record a difference between two or more variables and description that records a change. A "difference" makes description possible, and "change" makes the difference explainable over time. Meehan (1968:40) believes that "change" requires explanation while "differences" do not, they just are. Therefore, explanation is only valid when framed in terms of change.

"The minimal requirements for adequate explanation are 1) an empirical description containing both classifications and relational propositions, linking two or more of the events in the description, and a record of change, 2) an explanatory mechanism that can generate expectation that have empirical relevance" (Meehan 1968:47-48).

Once we have delineated a number of variables and their relations, these form a base with which we may compare its degree of isomophism with the empirical world pattern. The system constitutes the organizational aspect of the P-D model. Meehan (1968:48) defines an explanatory system as a "formal logical structure, an abstract calculus that is totally unrelated to
anything in the empirical world." The purpose of which is to generate expectations within its boundaries. Within the calculus the effect of the interacting variables is completely justified; the entailments of a logical system are necessarily and indefeasibly true. The system is considered closed at this point for the purpose of the social scientists becoming more familiar with the variables and their interactions. With a closed system the author feels that one may artificially manipulate or "play" with the interrelations of the variables. This "play" is evaluated by comparing the posited interrelationships with the empirical world pattern and noting which interrelationships consistently reappear. In this manner we may determine which variables are important and which are not. With a grasp of the basic system, we reopen it to new variables and interrelationships and reassess their isomorphism with the empirical world. By repeating this process we will develop more powerful explanations. Specifically, after a set of preliminary variables and interrelations have been developed, the temporarily closed system (or theory) is a set of variables (V) and rules (R) or postulated laws, that define the interaction among the variables.

\[
\begin{pmatrix}
V_1 & V_2 & V_3 & \ldots & V_N \\
R_1 & R_2 & R_3 & \ldots & R_N
\end{pmatrix}
\]  

from Meehan (1968:50)
The parentheses symbolize that the system is formal and closed. Within the parentheses any change can be completely accounted for through changes in the other variables. \( \varnothing \) symbolizes the outcome of the system which is that the manipulation of the variables and/or the rules of the system, produce a number of results, each potentially being equally valid. The variables are formal and have meaning only in terms of the calculus and not empirically. When the system is used in explanation and the terms of the calculus are loaded with concepts that have empirical relevance, the system becomes open and the variables take on empirical meaning.

The formal calculus is a theory of explanatory organization and the stipulated rules are the laws that govern the interrelations proposed by the theory. With the formal calculus complete, the deductive model is incorporated to test the explanatory power of the calculus. We use the deductive model as formulated by Hempel and Oppenheim (1969). This model is presented in the following schema:

<table>
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<th>Statements of antecedent conditions</th>
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</thead>
<tbody>
<tr>
<td>Logical Deduction</td>
<td>General laws (postulated laws)</td>
</tr>
<tr>
<td>Explanadum</td>
<td>Description of the phenomena to be explained. (potentially/actually empirically verifiable)</td>
</tr>
</tbody>
</table>

In theory it is possible within the formal structure, closed
by the inclusion of all the relevant variables, to determine all the possible outcomes. Total explanations would have to include all relevant variables, to determine all the possible outcomes. Total explanations would have to include all relevant variables outside the parameters of the problem. However, this is not possible as we have no method by which variables outside the problem may be specified. Relevant variables are only definable in terms of a problem and the problem is event(s) specific (cf. Ashby 1970:102-103; and Chamberlain 1966). This is just an admission that we can never fully explain phenomenon. (Refer to eight characterizations of explanation given by Kaplan in the last section).

Thus, there is a possibility that the outcome of the hypothetical laws will be other than expected. There are a number of reasons for this. First, the stipulated laws may be incorrect, the description may be inadequate (the classificational and/or relational properties), the concepts or patterns may be inaccurate, and all of the above may be interacting simultaneously. Second and more important, the outcome may also be modified by variables external to the calculus exerting an influence we do not perceive at this stage of our investigation because the system is considered closed. Given this situation, Meehan (1968:93) states:

"It is both convenient and useful to deal with discrepancies between system predictions and empirical observations by adding a _ceteris paribus_ clause to the loaded system when it is applied to an empirical situation".
The *ceteris paribus* clause is a constant and represents the unknown factors possibly producing the discrepancies.

The purpose of keeping the system closed is primarily to allow the social scientist some degree of control over the relations. If the system were considered open and one was testing a hypothesized interaction, one would have to consider so many influences that the explanas would become unmanageable. By closing the system via a "problem" orientation, we hope to keep the number of interrelations in the explanas manageable and thereby allow the social scientist some degree of manipulatory freedom.

If the degree of isomophism is low, therefore a *high ceteris paribus clause*, the social scientist can open the system to new variables and repeat the process of testing. A more complex system will produce a greater degree of isomophism as it more approximates the empirical world.

The following is an example of the P-D Model.

---

\[
\begin{align*}
V & \xrightarrow{R_1} V_1 \\
V & \xrightarrow{R_5} R_4 \\
V_4 & \xrightarrow{R_6} V_3
\end{align*}
\]

\[
\begin{align*}
V_1 \rightarrow V_5 & \quad \text{are the variables} \\
R_1 \rightarrow R_6 & \quad \text{are the postulated laws} \\
(\quad) & \quad \text{indicates the total theory} \\
\rightarrow & \quad \text{indicates the direction of influence}
\end{align*}
\]
Suppose we desire to test law \( R_3 \) which states that "\( V_3 \) will influence \( V_3 \)". The statement of antecedent conditions includes:

With the operationalization of \( V_1 \) by \( R_1 \), it will stimulate \( V_2 \) by \( R_2 \).

The postulated law states:

\( V_2 \) stimulates \( V_3 \) according to \( R_3 \).

The description of the phenomena to be explained is:

\( V_3 \) is operationized as indicated by a change in its state.

This process results in the juncture of the pattern and deductive models forming the P-D model of explanation. It may be employed to test any law or combination of laws within the calculus. When combinations of laws are tested, they cannot include the whole calculus as one cannot conceptualize the whole calculus simultaneously; the calculus has to be partitioned to be manageable. The decision of which laws to test at a given time is governed by their interrelations with other variables. One could not test laws \( R_3 \) and \( R_5 \) in a single deductive model because they are not logically connected except by laws which are not included in the explanans. Only laws that have stated logical relationships, as in our example, may be tested at one time.

Summarizing, our P-D model consists of generated expectations

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within a formal calculus and the transference of these expectations, as testable hypotheses, to the empirical world. The formal calculus is the system of theory consisting of stipulated rules or postulated laws; it is an abstract calculus that is totally unrelated to anything in the empirical world. The key to using this model for explanations is the generation of expectations within the boundaries of the formal calculus and the transference of these expectations, under suitable conditions, to the empirical world.

Evaluation of Explanations

One of the more important aspects of explanations are their evaluations, the method by which we judge if an explanation is "good" or "mediocre" according to specified criteria. If social scientists desire more than an understanding of phenomena, then we agree with Meehan (1967:19-21) that the principal requirement of explanation is that it provides control, in actuality or principle, over an empirical situation. We further believe that control is not the only criterion but that prediction and logic are also integral aspects of the evaluation of explanations.

Control is the determination of which variables co-varying with other variables are more critical in affecting the outputs of various sub-systems. To intervene in the systems operation, we have to be able to determine which variables would be amenable
to our efforts and at the same time enable us to accomplish our purposes.

Prediction involves the ability to stipulate what will happen given various system inputs in the future. Prediction is a necessary ingredient for control but control is not crucial for prediction. We can make predictions without the ability to control the consequences; to control the consequences, we have to be able to predict in order to modify variables so the desired consequences are achieved. As explanations based on the P-D model are probabilistic or "open", then predictions are also probabilistic or "open". The degree of prediction is a function of the degree of isomorphism between the pattern and the empirical world. With a greater degree of isomorphism, we assume that the probability of predictions will be accurate if we introduce new situations to the existing system.

In conjunction with control and prediction, the explanation has to be logically deducible, not to the purist standards of Hempel and Oppenheim (1969), but deducible meaning very likely. To operationalize this criterion, 1) the explanadum has to be a very likely consequence of the explanans; 2) the explanans must contain general or postulated laws; and 3) in principle the explanans must have empirical content as we assume, in principle, the explanandum to have. Meehan (1968:47) states a fourth criterion: "pragmatic success is the prime criterion for judging the adequacy and reliability of the explanation". We believe that although pragmatic
success is important, it is a function of logic, prediction, and control and thus not a "prime criterion". Kaplan writes that success in practical applications outside the context of inquiry "is neither a necessary nor sufficient condition for validation" (1964:319). We concur with Kaplan because explanation may fail for many reasons external to the theory being applied. This point is especially pertinent when we assume all explanations to be open and thus subject to some degree of failure.

Explanations are considered valid when they meet the following six requirements which are an integration of ideas expressed by Meehan (1968:102) and Hempel and Oppenheim (1969:55-56).

1. Explanations must be isomorphic to an empirical situation.
2. The predictions should be dependable.
3. The means of intervention the explanation suggests should enable the user to achieve some specified purpose.
4. The explanans must contain some type of law.
5. The explanadum must be a very likely consequence of the explanans.
6. Both the explanans and explanadum should in principle have an empirical content.

The evaluation of an explanations validity is a function of whether or not the proposed theory, which in principle enables
intervention with described empirical events, produces expected outcomes. Thus the quality of an explanation is evaluated in terms of the above six criteria. Quoting from Meehan (1968:24):

"A weak explanation provides minimal control over a limited part of the environment, control that may be in various degrees unreliable; a strong explanation provides accurate and reliable control over substantial parts of the environment. The scope, power, reliability, and usefulness of an explanation can vary greatly, and each explanation must be evaluated separately in terms of specific purposes".

The quality of explanation may be improved by modification and amendment through new hypotheses testing (the deductive method) based on the results of previous hypotheses.
THE GENERAL SYSTEM

This section of the thesis defines a general system model utilizing heuristic concepts to facilitate communication when discussing systems. Our operationalization of the systems approach does not consider empirical systems to be formal calculus having fixed absolute boundaries but rather considers empirical systems to be open with flexible boundaries. What we have presented up to this point is a method of handling systems once they are defined. Presently, our purpose is to provide the reader with concepts which will enable them to perceive or define empirical systems and then incorporate the P-D model to explain them.

Implicit in the model is that it is applicable to any level of system. Thus when one of the terms is discussed, its relation to the other terms is comprehended. The terms are static as they do not in and of themselves imply or explain change. They abstractly represent the entities modified.

Our view of the universe is one of a continuum of interaction, be it sub-atomic to defined space occupied by entities visible to hominds. The terms represent entities that may be differentiated given various criteria useful in understanding relationships. Thus, whatever the interrelationships the terms refer to, it is always
inferred that the entities are composed of other sub-systems interacting at a lower abstract level.

The terms are: (1) node, (2) channel, (3) boundaries, (4) networks, (5) hierarchies.

1. **Nodes** are potential variables in the model of the system. They are the smallest defined elements in the postulated system. They may be physical or abstract. In contrast to the "variables" in the formal calculus of the P-D model, notes are not permanent as they may be created or destroyed, a function of how the system is modified.

2. **Channels** interconnect nodes. Again, they may be physical or abstract. A channel between two or more nodes has the ability to become operational depending on the type of information/energy input to the system. The loss of this ability to become operational occurs when a system is modified to such an extent that the channel is permanently altered. The type of channel influences the amount of noise in the information transmitted and the amount of energy lost to entropy. Channels have an upper limit or capacity due to either physical or abstract constraints. Channels have an analogous counterpart in
the P-D model, the stipulated rule or postulated law. Both serve the function of interconnecting phenomena; the difference is that postulated laws state how the interaction is controlled or governed while the channel constitutes the mechanism for interaction.

3. **Boundaries** in social systems are heuristic devices defined by the observer. This conclusion is also presented in Pietmas and Weingartner (1969:78) who write that the "structure" and thus its defining criteria are a product of the cognitive processes of the perceiver. (Cf. Stein, 1971: 167 who states that information/energy exchange between the system and the environment causes boundary change; boundaries change with growth, maturation; and learning.) Following Dunn (1971: 189-91) we will consider the boundary as a behavioral design, "a pattern that constrains the behavior of sub-system components (nodes) to action modes consistent with design." In behavioral systems, the boundary or definition of the system is a function of its purpose or goal. Boundaries defining systems are hierarchical and emergent thus organizing lower order purposes in a manner consistent with the more inclusive sub-systems control.
4. Networks or sub-systems consist of nodes/channels that are differentiated from other nodes/channels. They have a purpose of goal. Networks, like nodes and channels are abstractions primarily conceived of or defined by the social scientist. All the nodes/channels of a network may not always be operationalized at a given time. Networks then, are abstract patterns defined as relevant to a given problem by a human observer.

The differentiation of networks includes the following:

(1) Networks interact on a continuum. The continuum is defined as a gradational differentiation based on the intensity of information/energy in one network as compared to another, the kind of information/energy activated in one network as compared to another.

(2) There is never any empirical or complete boundary.

(3) The intensity/kind of information/energy accepted by a given network is a function of the state of the network and the surrounding networks.
(4) Nodes and channels may be in multiple networks at one time or at different times. This being a function of the kind/intensity of the information/energy inputting to the system.

5. **Hierarchies** consist of network interrelations. They are abstract and seldom fixed, static, or permanent (cf. Laszlo 1972:Chapter 9). They are differentiated by complexity and the intensity/kind of information flowing in specific networks. Hierarchies are established through time as the result of various networks combining and/or integrating with other networks to form more complex patterns. Implicit in a hierarchical structure is that lower, less complex levels are in some manner controlled by the higher more complex levels (Cf. Milsum 1972:164; for a detailed discussion of the role information exchange hierarchies have in evolution see Milsum (1972) and Simon (1965)).

Social system hierarchies are a function of activities or behavioral specializations. As activities are not all interrelated in the same manner, they form functionally related clusters (networks). These networks organize and are organized by either internal or external system boundaries that impose controls upon component
behaviors (Dunn 1971:191-92). In different states of the social system networks vary their influence in terms of input/output. Over a short period of time the social system does not take on a permanent hierarchical form as it is multi-purpose in character. In the long run, however, the evolution of social systems has developed a hierarchical form, becoming more complex to facilitate control and organization. (See Simon (1965) for an explanation of why.)

The role hierarchies play in explaining social behavior utilizing the P-D model is a function of the elapsed time of the explanation. Thus an explanation involving a short elapsed time may not indicate hierarchies while in an extended observational period hierarchies may be perceived.

These characteristics of systems differs from our "purist" conception of system in the P-D model. First, in the P-D model, the boundaries are fixed and absolute, enclosing all the relevant variables. However, in the empirical world boundaries are not impenetrable and are defined in terms of a continuum of information/energy. Secondly, the P-D model considers systems to be closed with no inputs or outputs. This contrasts with the empirical world which is seen as relations consisting of inputs and outputs. Therefore, in the operationalization of the P-D model the formal calculus is seen as closed but the resultant explanation is open.

This brief discussion dramatizes the fact that the P-D model is an abstract calculus unrelated to the empirical world. Once one
has experienced the "context of discovery" in the empirical world, the "context of justification" demands that we put parameters on our experience in order for comprehension and explanation. Perceiving the world in terms of nodes, channels, boundaries, networks, and hierarchies enables one to comprehend and operationalize systems by organizing phenomena; applying the P-D model enables one to explain the experience and thus a portion of the world.

Having discussed the structure of our general system, we will now examine the process by which the system is modified through time, i.e. feedback.

![Simple Feedback Model](Taken from Bertalanffy (1962:1-22))

Following Maruyama (1968), we agree there are two types of feedback. Deviation-counteracting and deviation-amplifying mutual causal processes; the first and second cybernetic respectively. Deviation counteracting processes attempt to keep the system within established parameters. It is identified with a specific level of operation (goal) which is considered to be of benefit to the system's maintenance. It does not deal with changes that have a
tendency to amplify a possible deviant condition in the system (Maruyama 1968:304). Deviation-amplifying processes are those which amplify an insignificant or accidental initial kick (stimulus) to increase deviation and diverge from the initial or established condition (Maruyama 1968:304).

The effects of deviation-amplifying and deviation counteracting processes are transmitted along the channels to nodes and affect the modification of network intensity. This is accomplished by amplifying or decreasing the output of the organizing network. If a network is operationalized such that at certain levels other channels and nodes are activated, in turn transmitting information back to the initiating network causing a decrease in output, we have a deviation-counteracting process. The other possibility is that a network may become operationalized causing another network (increasing its output) that affects the original initiating network to further increase its output. This interrelation is deviation-amplifying.

There are two results of a deviation-amplifying feedback loop. One, the "First Cybernetic" can control the "Second Cybernetic" and the tolerance parameters maintained, i.e. system self-maintenance. An example would be the thermostat in a heating system. Secondly, the "Second Cybernetic" affects the system in such a manner that the "First Cybernetic" cannot maintain the established tolerance level, and the system either re-establishes a new tolerance level (modifies the original goals); or the system is

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permanently modified (structurally) in such a manner as to produce a new system interaction (production of new goals.) The important idea is that the process of deviation counter-acting and amplifying is going on continuously.

Having discussed the mechanism of change, feedback, we will now consider the cause of change via feedback, information and energy. The information content of a message is defined in terms of a measure of change in the observer's knowledge. D. McKay in Buckley (1967) writes that information does logical work on the organism's orientation. This logical work or meaning operates as a selective function on the range of the system's possible states of orientation. Information organizes the system with potential constraints governed by the system's previous states.

The sequence of events involves an information source (node) which selects a desired message out of a set of possible messages. Next the transmitter (channel) changes the message into a signal which is sent over a communication channel to the receiver (node). Finally, the receiver or inverse transmitter, changes the transmitted signal back into a message.

There are two general constraints on the mechanism described above. One, the meaning and effectiveness of the information is restricted by the limits of accuracy in symbol transmission (verbal/nonverbal). By this we imply that information can be disseminated which is known to be false or biased. As information organizes
the system, false information can manipulate the system to certain goals which may be maladaptive in terms of survival. Secondly, it is characteristic that in the process of transmitting the signal, certain things not intended by the information source are added to the signal, i.e. noise. Noise has occurred when the received message contains certain errors, extraneous material and certain distortions which lead to increased uncertainty. Increased uncertainty means that the received signal is selected out of a more varied set of signals than was intended by the sender. Referring to our definition of a channel (page 32) we may now add:

"The capacity of a noisy channel is . . . equal to the maximum rate at which useful information (total uncertainty minus noise uncertainty) can be transmitted over the channel" (Weaver 1949:49).

Because of noise and the selective features of the information source, the received information is probabilistic. For this reason, it is important to define the type of channel operationalized, because the noise levels associated with different channels are variable.

Directly corresponding to information is energy. We are defining energy in its physical sense as related to the potential to do work. In the previous discussion concerning noise in channels, we noted that noise in energy channels decreases the amount of input obtained by the receiver. There is an energy loss during transmission. It takes energy to obtain knowledge and information to harness energy. Therefore, information is needed for the transformation of energy into an operational entity useable by socio-cultural systems.
Resulting from the above discussion is the definition of change used in this paper. Change is the modification of nodes, channels, and networks due to deviation-amplifying and deviation-counteracting mutual causal feedback processes of information and/or energy. In the development of organic systems from a biological level to a socio-cultural level, information has become more influential than energy. This is supported by Buckley who writes that "the nature of the mechanisms by which the systems' changes of state are specifiable functions of the selective nature of information." (1967:121) The degree of change in a system is a function of the amount and kind of information/energy that a system can integrate via its feedback mechanisms. This is a function of the goals of the system, i.e. the needs, desires, or requirements made manifest as guides to and motives for action (Dunn 1971:164). We established that information is probabilistic and, therefore, change is probabilistic. Thus, the investigation and explanation of change must deal in terms of probabilities and open ended statements as indicated by the P-D model.

"Interrelated social networks are not put in place intact; they evolve. They develop by adding new channels, reorientating old channels, modifying channel capacities, and superimposing new network segments upon old. This is a consequence of the fact that social systems behave as learning systems. A capacity for creative learning is essential for the transformation of social systems" (Dunn 1971:123).

Thus, social change is a result of learning on the part of the individual or the society. Learning, or the meaningful integration (mapping) of new information, allows the individual or
society to affect the social process they are enmeshed in. Thus, they can sort out from a number of possible alternatives the hypothetical solutions to problems based on the system's state and goals. If in its present state the social system cannot solve the problem, it has two alternatives. It may lose its vitality as a functional goal/boundary maintaining system through physical death or dispersal of its members; or the goals and boundary maintaining purposes may change (all or a portion of the social system) and the social system will preserve its vitality.
THE IMAGE OF LIMITED GOOD:
FOSTERS EXPLANATION OF BEHAVIOR IN TZINTZUNTZAN

The demonstration of the P-D model will utilize data from the Mexican peasant village of Tzintzuntzan (Foster: 1960-61, 1962, 1963, 1964, 1965a, 1965b, 1966, 1967, 1972). To enable the reader to evaluate the systems perspective we will present Foster's explanation of behavior in Tzintzuntzan and then an alternate systems explanation. As Foster's explanatory mechanism is well known in the anthropological literature (See Foster: 1967), the following pages will be primarily devoted to explicating our systems application. After presenting Foster's explanation, we will discuss the systems model structure, i.e. nodes and feedback channels, and then its function over time, i.e. how the model interacts with various stimuli. At this point we more readily will be able to evaluate the explanatory potential of both models in terms of their logic, prediction and control.

A general characteristic of Foster's explanation is the focus on the explicit and implicit psychological organization of the indigenous population, while our model deals with a greatly expanded system in which the psychological organization is one of many nodes. We believe Foster considers a given psychological cognition as having causal priority over the behavior of an
individual's life for he writes that the initial research role of the anthropologist is:

"Above all (a) means finding out how they (the peasants) think and reason, learning the bases for their logic, and fathoming the premises that underlie their behavior and determine their responses. . . " (1967:74)

The reason is that:

"The explicit and implicit assumptions that characterize the cognitive orientation of recipient peoples in a directed culture change program will have a major influence on their ability or inability, their willingness or unwillingness, to change traditional behavior." (1969:82)

Foster believes that all members of a society share a common cognitive orientation, an implicit understanding of the rules of the game. "All normative behavior of the members of a group is a function of their particular way of looking at the environment". (1967:300) Foster's concern with the psychological cognition of peasants is operationalized through the concept of limited good. Specifically, the title Foster gives this concept is "Image of Limited Good" and is defined as:

"broad areas of peasant behavior (that) are patterned in such a fashion as to suggest that peasants view their social, economic, and natural universe--their total environment--as one in which all the desired things in life such as land, wealth, health, friendship and love, manliness and honor, respect and status, power and influence, security, and safety exist in finite quantity and are always in that supply as far as the peasant is concerned. . . in addition, there is no way directly with peasant power to increase the available quantities." (1967:304)
A schematic diagram of the model is presented in Figure I.

Foster (1967:304-305) characterizes the peasants of Tzintzuntzan as considering their existence to be determined and limited by the natural and social resources of their particular village. It follows that an individual or family can improve a position only at the expense of others. Any increase in the "good" of an individual and/or family is seen as a threat to the entire community. This results in a feeling of uncertainty as to who is losing "good" to balance another's gain. In the concept of limited good Foster sees any significant improvement by individual(s) or family alone as a threat to all individuals and families. According to Foster, the result is that leveling mechanisms are developed which function to keep the families and the individuals of Tzintzuntzan in equilibrium. Change, for individuals or families, is not permitted but is restricted to the village as a whole.

Forde and Douglas (1967:13-28) also see a concept of limited good operating at the peasant level. For example, they found that a household that had recently prospered is forced through public opinion to share in their new wealth. The obligation to distribute the income is the result of two factors: (1) a constant menace of want, resulting in a dependence on others and (2) the technical difficulty of conserving goods for future consumption. Therefore, when a family shares its surplus, it gains not only in prestige, but also via the obligations of others to repay them in the future, thereby providing a formal insurance.
This model represents the filtering aspect of limited good. Any modification of the variables on the left is filtered through limited good and initiates an appropriate response on the right which feeds back to the nodes on the left to counteract the modification.
Foster proceeds to illustrate the concept of limited good by demonstrating that (1) the economy is limited through an interaction of population, land, production techniques, and environmental deterioration (1967:32-54); (2) friendship is considered limited as evidenced by the institutionalized best friend (1967:55-85); (3) health is viewed as limited, a conclusion based on the peasant's unwillingness to give blood (1967:184-193); and (4) a peasant considers his manliness and honor as limited in relation to his peer group (1967:55-85, 122-152).

An example of the cognitive processes based on limited good is the interactions that take place when a child is born. For reasons discussed in feedback #18 Appendix II, a child is seen as "good". The family has gained an advantage over the other villagers and, therefore, is envied; someone has "lost", although the losers are unspecifiable. To reduce the intensity of envy when the baby is born, the father tells the other villagers that they "have a new servant at your disposal in your house" (Foster 1967:159). Also, the baptism is carried out by the godparents who, after the service, throw coins to a crowd of youngsters, thereby also allowing them to share in the "good" of the birth. These acts, then, prevent the family from being the recipients of intense envy. Various other acts protect a person from envy when they find something new or desirable, have an abundance of a
scarce commodity, or are deprived of something "good" (Foster 1967:157). The acts generally involve (1) the placing of the envied object at others' disposal, the object becoming non-enviable thereby; (2) sharing the scarce commodity before it may become envied, such as house warming fiesta; or (3) offering small gifts to people who have suffered a loss, thus not incurring their envy (Foster 1967:153-166). A "good" from the possessor's viewpoint is symbolically or materially diluted so that others will not feel envious and may in some instances even partake of the good. The goal is to prevent or divert any envy.

The above information suggests that the preferred behavior is that which preserved the relative position of people in relation to each other and maximizes security, that supports the statement "were we are all equal" (Foster 1967:136).

There are two principal processes which maintain village stability: (1) an agreed upon preferred norm of behavior, and (2) sanctions and rewards to force/inspire personal behavior. These processes are networks which function as "leveling mechanisms" (Nash 1967:8; Foster 1967:138-141). The leveling mechanism is a means of forcing the "expenditure of accumulated resources or capital in ways that are not necessarily economic or productive. . ." (Nash 1967:8). The preferred norm of behavior is that people do not compete for prestige in terms of material items; the emphasis is on
trying to be inconspicuous in position and behavior (Foster 1967:139). The concurrent informal, unorganized sanctions include gossip, slander, backbiting, character assassination, witchcraft, evil eye, and possibly physical aggression (Foster 1967:314).

For manifest material fluctuations in the "good", a balance is maintained via formal or institutionalized conspicuous consumption in the form of ritual extravagance, primarily mayordomias and/or fiestas.

The peasant's perspective of his social-environmental inter-relations is that they are closed, indicating to Foster a cognitive organization focused around limited good. The Image of Limited Good logically precludes that mechanisms such as we have discussed will develop to maintain the system's viability. In a system that is seen as closed to new resources, any deviation in the direction of an excess of the system's existing resources by a member of the system will produce a more stringent condition for those system members not partaking in the excess. In a closed system, for a person to survive, one must be sure that his peers do not develop an excess for, in the end he loses. Thus, various sanctions are introduced to prevent excesses and to promote the psychological orientation of a limited good. We concur with Foster that a concept of limited good is highly rational in the context of traditional peasant cognitive orientations and also, it is influential for the maintenance of traditional peasant societies.
The usefulness of the Image of the Limited Good is that it will reveal structural regularities linking economic behavior with social relations, friendship, love and jealousy patterns, health beliefs and concepts of honor and masculinity. The result will be the explication of basic patterns most helpful in constructing the typology of peasant society (Foster 1967: 306; 125).
A SYSTEMS MODEL OF TZINTZUNTZAN

The Structure of the Model

An alternative to Foster's model of limited good is the systems model in Figure II. It does not offer a single organizational focal point to explain behavior, but suggests that behavior be seen as the result of, and interaction of, mutual causal processes. The theoretical basis and paradigm of the model has been discussed in the first part of this thesis.

As Foster was not employing a systems orientation when studying Tzintzuntzan, his data will not lend themselves to a systems perspective without modification. This modification consists of a reinterpretation of Foster's data, utilizing a classificational/relational organization and, subsequently, formulating the systems model. The model is proposed and constructed around qualifiable measurement and definition which illustrates the interaction of nodes and networks.

The model consists of the following nodes: Economy, Envy, Psychological fear, Psychosomatic illness, Machismo, Folk Medicine, Malnutrition, Disease, Population, Religion, Patron-client, Colleague, Pottery Making, Agriculture, and the Bracero Experience. Refer to Appendix I for a classificational definition of each node. These variables are the nodes with their interactions constituting various networks for the level of systems analysis of Tzintzuntzan.
This model represents the author's organization of Tzintzuntzan. The nodes are defined in Appendix I and the numbered feedback channels are discussed in Appendix II. The + associated with a channel implies that an increase or decrease of the output node increases or decreases the input node respectively. A - indicates that an increase or decrease in the output node decreases or increases the input node respectively. (+ = increase; decrease)
The boundary of each node is not characterized as rigid or absolute for three reasons (cf. Stein 1968:167). One, because the parameters of a node are determined by a problem, the parameters may therefore fluctuate (cf. Chin 1969:300). For example, depending on whether one is interested in family population or village population, the population node may pertain to the number of people in ego's household or the number of people in the village.

Two, there is no "natural" or "objective" decision as to whether any specific node will be considered relevant for a given question; the social scientist makes the decision as to whether any specific node will be considered relevant for a given question; the social scientist makes the decision on the basis of either an implicit or explicit formulated question (cf. Ashby, 1970:102-103). Third, the questions as to whether or not a variable is stimulated is not a yes/no type of decision in cultural information systems (See Laszlo (1972) for a discussion of thresholds in physical, biological, and social systems). In a mutually relational system, there is a gradation of intensity of influence, not an off/on dichotomy. Therefore given a specific problem, the social scientists decides (either implicitly or explicitly) as part of the hypothesis whether a node provides the kind and intensity of information to be incorporated into the hypothesis.

There are 57 postulated feedback channels interrelating the nodes of our systems model. Based on the type of information and/or energy flow, the feedback channels transmit either verbal, visual,
or tactile information. See Appendix II for a discussion of each one. This appendix indicates the relational aspect of the P-D model. The relations are psycho-social-environmental so that they may be oriented toward an ego, ego/village, or village/ego level of abstraction. The arrow between two nodes indicates the direction of information/energy flow while the + or - indicates the change in the relationship due to the information.

The feedback channels function as postulated laws and although they may appear individually as a cause-effect interaction, they are not (cf. Chin 1969:803). The reason is that the stimulus of any given node is the result of multi-feedbacks and the effect of the stimulus upon another node is only part of other input feedbacks of varying intensities. Thus one node alone does not affect another node, but is the result of multi-causes and the affected node is multi-affected (cf. Stein, 1971:131). (This provides the basis for open explanations and equifinality). The postulated law only states how (+ or -) the two variables are related and the direction (→) of influence. The kinds of stimulus to the output node will determine the kind and intensity of information to its input node(s) and in conjunction with other inputs, influence the output of the input node.

Any specific relation may or may not be a system specific law. We may find this specific feedback channel in another system, but not the other relationships which in conjunction with it produce a specific kind and intensity of output corresponding to the original
system studied (cf. Kay (1970) and Berlin (1970)). They discuss the perception of color cross-culturally (etic) and specific nuances that are culture specific (emic). Thus, a given statement governing two nodes relationship is potentially etic oriented, but specific examples (a loaded system) are emic or system specific. The feedback channels are part of a total system and if removed from the system, their ability to indicate strong probabilities is reduced.

Networks are interrelated nodes connected by channels carrying specific types of information which stimulate highly probabilistic types of responses. The networks are defined by the social scientist in terms of a problem that the system has to deal with (cf. Ashby 1970:102-103). The process of solving the problem constitutes the network. The question that is asked is, given a stimulus and its intensity, which nodes are most likely to be affected, based on the feedback interactions? Thus, the choice of which nodes to include in any given network are determined by the logic perceived in the system (constituting a hypothesis). When the problem is "solved", i.e. a postulated response by ego or the village, the network is compared to Foster's discussion of Tzintzuntzan and if the degree of isomorphism is great, the postulated network may be used in more complex problem solving situations. If data is not provided with which to compare the postulated network, it is considered a justifiable hypothesis and/or potential problem solution.
The boundaries of the nodes were determined by Foster as he made observations which organized his perceptions about Tzintzuntzan. The boundary of the system is based on what Foster considered to constitute the traditional system and what I could specifically determine as inputs external to the traditional system.

The delineation of hierarchies is dependent on the specific question(s) one asks as various nodes may seem more critical (influential to the outcome) than others. There is not a "natural" or permanent hierarchy of nodes characterizing the model for either short or long time spans. It is apparent, however, that economy and disease are quite influential or critical to various system outputs. The reason is that their relative frequency and intensity of interaction in comparison to other nodes is high, although two ideas must be kept in mind; one, they are affected by inputs and are not just output producing and, two, this observation is most likely biased as a result of Foster's interests as an observer.

There are hierarchies in Tzintzuntzan which are defined in terms of status and power, e.g. the patron-client relation and the priest-villager interaction. The purpose for definition of these and other hierarchies within Tzintzuntzan which exist with external system nodes is for the determination of the type, intensity, frequency, and sequence of information introduced by the change agent. One would not introduce the same information to a priest as one would to a village because the psycho-social-environmental matrix of each is different in kind and complexity. I believe that the defining
of hierarchical situations will help the change agent provide
information to the different parties that is most meaningful
and pertinent to their respective situations.

Following the P-D paradigm, the model has undergone several
stages of expansion, becoming increasingly complex. At each
stage the process was to incorporate more nodes/feedback channels,
and close the model by not considering external nodes or input.
After feeling that I understood the interactions of the closed
system (the networks appeared to become increasingly more isomor-
phic with Foster's data.) The model was reopened by increasing its
complexity. With each increase in the complexity of the model I
found my proposed interactions described more closely the observa-
tions made by Foster (cf. Chin 1969:303).

How the Model Functions

In operationalizing the model, one first assumes that a
stimulus or initial kick (Mauryana 1966) affects a node, trans-
mitting information to another node. As previously emphasized, the
problem as defined by the social scientist will stipulate when a
given node/intensity of information ratio becomes significant to be
incorporated into the network. Following the P-D model, we then
trace the outputs of the node that was stimulated. Given the type
of information, we predict either an increase or decrease in the
intensity of the affected node. Depending on our problem, some
feedback channels will appear more logical than others and these
feedback channels are now designated postulated laws. By repeating this process for each node, we construct a network which approximates the way ego or the village would react and solve the problem. Some of the problems or situations we may investigate include: (1) what happens if a specific node is stimulated? (2) what is the relationship of two nodes given different types of information? and (3) what occurs if an environmental input influences the traditional system? Utilized in this manner, the model becomes a device with which we may predict psycho-social-environmental behavior in Tzintzuntzan.

Given that we have delineated a network that will potentially solve the problem, for purposes of control we may theoretically enter the network at any point. In practicality, it will be most expedient to enter the network at a point where potentially we have the greatest amount of control. This implies that the selection of the entry point is determined by whether it is amenable to our directed modification and whether we consider it more influencial than other entry points in the network (cf. Stein 1971:1969). Later we may determine that another entry point is more relevant in solving the problem and/or influencing the system.

In discussing an example of the first question, what happens if a specific node is stimulated, we will utilize the following network dealing with increase in ego's economy within the setting of the traditional Tzintzuntzan system.
We will enter the network at the node economy for it is easier to measure relative to the other nodes and Foster emphasizes this node in his observations of Tzintzuntzan. We will suppose that ego has an increase in his standard of living relative to what it was for any number of reasons (Feedbacks #52, #51, #41, or #43, Appendix II). This is our initial kick. Simultaneously, ego is now involved in two psycho-social networks depending on the level of abstraction; ego's interaction with his peer group via visual and verbal information flow and the internal cognitive processes that primarily only involved ego.

Following the feedback channels, an increase in economy may cause a decrease in malnutrition (#22) because ego will be eating better and possibly become more healthy. With a decrease in malnutrition, (#14), ego's machismo may increase, for he may become physically stronger and thereby more able to provide for and defend his family against any type of distress. It follows that an increase in machismo may cause a decrease in psychological fear of the future (#56), for ego is more able to cope with his environment. With a decrease in psychological fear there may be a decrease in
psychosomatic illness (#11) as ego may not develop ulcers or any psychosomatic disease. Completing the loop (#40) postulates that a decrease in psychosomatic illness may sustain or increase ego's economy as he is not preoccupied with fears and worry.

Concurrently, ego is also involved in a network that includes his peer group. With an increase in ego's economy, he will incur the envy of others towards him (#2). If ego believes others envy him, this increases his own psychological fears (#7). This involves the fear of what people will say and/or physical aggression. One possible way of decreasing or eliminating his fear is to increase his religious activity by sponsoring a *mayordomia* (#30) which consumes ego's wealth and decreases his economy (#37).

We see that in the traditional system ego is involved in many networks that are at various levels of abstraction from himself. They form a hierarchy, for depending on other concurrently operating networks, ego will make a decision as to what course of action is best. In the example, we are predicting that ego will sponsor a *mayordomia* at the sacrifice of his own betterment to decrease his peer group envy.

To provide an example of the second question dealing with the relationship of two nodes given different types of information we will discuss the following network.

![Diagram](image-url)
The node disease will facilitate our entrance to the network as relative to the other nodes, it is the most easily observable by the social scientist. If ego becomes sick, his envy of others increases (#5) because they are not suffering or incapacitated from any illness. Concurrently, ego's psychological fears increase as the result of two types of information. One type (#10) involves the thought that ego may not be able to provide for his family via his own means. The second type (#7) centers around the thought that the healthy villagers may think that ego will envy them and they may in turn, try to prevent this envy. This process may cause increased distress in ego, for he fears the acquisition of envy by others. This increase in psychological fear may cause ego to activate this colleague ties (#35) which will provide ego with goods and/or services. The type of information passing from ego to his colleagues (#35) is that ego needs help and wants to collect past debts. The information passing from the colleagues to ego (#8) decreases ego's psychological fear because his fear because his colleagues will help him. Thus, different results depending on the time relationship of the nodes. This is in contrast to feedback channels #5, #10 and #7, which also involve different types of information but interact simultaneously producing an effect which is the result of mutual causal feedback.

The third question involves the input of information from an outside source to a node within the traditional system. We will
examine what may occur if hygiene, immunization, and sanitation are introduced, feedback channels #53, #54, and #55 respectively:

With the introduction of sanitation, immunizations and hygiene procedures, the intensity of disease decreases as the village becomes a healthier place to live. As the people are healthier, they may produce more children (#29) and the population increases. With an increase in population there is a decrease in the land's productivity (#45) due to the greater demand placed on the land, i.e. it has to be farmed more intensively. Over time the land will become depleted of nutrients and agricultural production will decrease (#44). With a decrease in agriculture, the economy (#41) decreases as there are more people to be fed, but not the means to feed them. This may stimulate an increase in malnutrition (#22) and result in an increase of disease (#24). We predict as the consequence of this network an increase in disease, although the external nodes were intended to accomplish just the opposite (Cf. Foster (1967:280) where he discusses an increase in population and a decrease in agricultural production.)

In summary, for the social scientist to operationalize the model, he (1) has a problem or question for which he postulates
a stimulus or initial kick, (2) examines the various feedback channels output, (3) chooses the ones he feels are most relevant for answering his question, (4) examines the effected node and its output, and (5) repeats the process until he feels a solution has developed.

We shall now examine our model and see how its operation requires sanctions to keep it within parameters of a level of operation, i.e. to satisfy the goals of the peasants. A basic proposition operating in the model is that economic networks are unstable and do not provide security. This is due to limited land, limited improved production techniques, limited economic inputs, limited natural resources from outside the system, and an intense disease factor. Since almost all peasant societies are also characterized as agrarian, fluctuation in crop production is one of the primary unstable factors (Forde and Douglas 1967:15).

As the economy is unstable, it cannot be depended upon for future wealth. (Cf. Foster (1967), who writes that as a result of the limitations listed above, peasants do not see a correlation between increased work and increased wealth.) A surplus is not accumulative over a number of years as the peasants lack storage facilities (Forde and Douglas 1967:21), and in the majority of cases, what is produced is either consumed or used as payment of debts. Therefore, processes have evolved which ensure a readily available resource to be utilized when the system is outside the parameters of an operational level, i.e. ego's subsistence is below or above a "normal" level.
These processes center around the fact that the villagers have to depend on one another for assistance. This need for help or assistance is relative to ego's and the communities system state. (Cf. Weinberg's (1965) article explaining the Kwakiutl potlatch in terms of various group relations relative to their subsistence level.) Based on Foster's data, we may assume that at various times the peasants are more or less worried about survival. We may further assume that if one worries about survival, one is worried about the future and one's actions may be future orientated. In peasant society future actions consist of mechanisms which provide and sustain personal ties and interactions. Because the physical environment is uncertain, the only control available to peasants is control of their personal relations. Processes involving personal relations and interactions are, therefore, very complex for they set up means that provide for a secure future.

These processes are inherent in the friendship network primarily consisting of colleague and patron-client ties; colleague relationships provide ties in everyday village life and patron-client relationships provide ties in emergency situations. I have concluded that one of the primary implicit functions of the friendship network is to provide security for ego. If there is a formalized type of relationship existing (colleague or patron-client), the doubt as to whether one will be able to receive help when in need is decreased. This conclusion is supported by our model. If
ego's economy is increased, his need for friendship decreases as his subsistence is more stable, his health increases and his machismo increases. Thus, presently, he does not have to rely on friends and becomes in turn a source of friendship ties for others who may be in a more precarious position. Later, the situation may be reversed and ego relies on friendship ties established earlier to provide him loans. These loans are payment for loans made earlier by ego and he either requests more than the repayment amount or does not request as much, in either case a balance is not achieved and the ties are still viable (Foster 1967:217).

If ego has an economic increase (better than average crop due to outside influences), this increase has the potential of putting ego outside the system as formulated. If ego invests his wealth in modern drugs, he may become healthier which will allow him to work more and/or he may go outside the system and invest in materials to further his crop production. In sum, this feedback loop has the potential of increasing ego's autonomy from the rest of his fellow peasants and potentially developing into class differentiation. I believe the primary reason class differentiation is unwanted is that it would decrease the number of potential colleague ties (fewer people participating) and thereby decrease ego's and the remaining peasants insurance which colleague ties provide (cf. Foster 1967:141).

As the friendship network provides ego with insurance on a personal level, other processes in the traditional system prevent
ego from participating in and taking advantage of the deviation amplifying processes. The processor or "leveling mechanisms" explicitly operating in the model are envy and religion. (Implicitly, any of the variables may act as a leveling or deviation-counteracting process depending on the system's state). The deviation counteracting processes associated with envy operate primarily on an individual level. Ego either fears the envy of others or he fears he will be accused of envy as the result of any real or imagined changed in the status quo. Fear of being envied involves increases in psychological fears and/or psychosomatic illness and the consequences they entail. The leveling mechanism for either real or imagined change provides the villagers a process for control over fellow villagers that results in a maximum number of people available for colleague ties and a viable system.

When the status quo is modified by real or achieved subsistence, increased religious obligations are utilized to counteract the autonomy producing behavior. This involves the sponsorship of a carguero in the mayordomia system which consumes much of ego's time and economic increase, thereby placing him back in the system. With his subsistence again decreased, he has to reply on colleagues for loans and the peasants interdependence is perpetuated. Therefore, if ego has an increase in subsistence, he if forced through informal and formalized sanctions to redistribute the increase to his fellow villagers. These are mechanisms which prevent the establishment
of economic classes, which provide security and insurance for the participants in the system.

We may conclude that the system depends on friendship interrelationships. If one goes outside the system, this decreases the number of friendship ties and leaves others in the system in a more precarious position as there are fewer people to depend on. Therefore, the implicit function of the system's sanctions is not only to keep the status quo, but also to keep the maximum number of people in the system.
THE SYSTEMS MODEL AND THE IMAGE OF LIMITED GOOD

Comparing The Two Models

In comparing Foster's model for explaining peasant behavior, the Image of Limited Good, and our model the mutual causality of interacting variables, we encounter the concept of equilifinity (Bertalanffy 1968). Equilifinity is defined as "the same final state reached from different conditions and in different ways" (1968:40). The postulates that both Foster's and my model (see Introduction) are built upon, are to some extent similar and, therefore, our "conditions" are not greatly different. Foster writes:

"In every culture, change occurs continually, although at vastly differing rates, so the elements of a culture are always in process of dislocation, and the struggle for their accommodation to each other goes on continually" (Foster 1969:75; cf. Stein 1971:133).

"Hence, a culture, at any point in time is always a compromise between stabilizing and dynamic forces; it is a system in a state of tension, of dynamic equilibrium, rather than of static repose" (Foster 1969:75; cf. Stein 1971:130).

"The basic point is, of course, that no change can occur in isolation. . .it must be evaluated with regard to all the other changes likely to occur if it is successfully carried out" (Foster 1969:75; cf. Stein 1971:130).

We are at variance with Foster in terms of the "ways" we have reached our conclusions and explanations. Foster (1967:304-305)
characterizes the peasant as considering his existence determined and limited by the natural and social resources of his particular village. The result is that leveling mechanisms are developed which function to keep families and individuals of a village in relational equilibrium. These interrelations and processes produce a cognitive orientation that is made manifest for the social scientist via the "Image of Limited Good". In Foster's opinion the "Image of Limited Good" will influence all parts of the peasant system to the extent that it will determine the response of networks to given stimuli. In his explanatory hypothesis a psychological orientation becomes the dominant organizer such that any information coming into the system or internally generated by the system is processed through this organizer and an appropriate response is manifested by the peasant (see Figure I). Thus the "Image of Limited Good" is an organizing mechanism which explains behavior in variables which may be considered separate. (See Foster 1967: 122-153; Limited Good in Economic Behavior; Limited Good in Friendship and Love; Limited Good in Health Beliefs; and Limited Good and Machismo, also reply to Foster in Comments 1972:189-190 by Faris.) In other words, Foster has based his explanatory model on a classificational universe.

Our explanation of peasant behavior exhibits the same results as Foster: religion and envy are seen as leveling mechanisms.
and friendship is seen as a security device, i.e. equifinality. The difference resides in the mechanisms by which the behaviors are explained. With systems analysis we have included both cultural and non-cultural variables. We have not postulated one variable (psychological cognition) as the main explanatory mechanism. We have postulated that mutual causal processes consisting of psycho-social environmental nodes interacting with and interrelational to the systems environment is the explanatory mechanism. A given node is meaningful only relationally in terms of its co-varying influence with other nodes. We thus follow a relational universe as discussed in the beginning of this thesis.

Evaluating The Two Models

In answering the question of which model has greater explanatory power, we have to be able to evaluate the explanations or models. We have previously stated the belief that social science has two general goals: (1) to develop methods by which human behavior past and present, may be understood for the purpose of solving current socio-cultural problems and (2) to develop control over increasingly complex social behaviors. To accomplish these goals, a "good" explanation will satisfy three general criteria: (1) it will be logical, (2) it will be predictive, and (3) it will provide a means to control or intervene in the system. More specifically, an explanation will be considered valid when it meets the following six requirements:
1. It must be isomorphic to an empirical situation.

2. The means of intervention should enable the user to achieve some specified purpose.

3. The predictions should be dependable.

4. The explanas should contain some type of law.

5. The explanation must be a very likely consequence of the explanas.

6. Both the explanas and explanation should in principal have an empirical content.

Both models meet the last three requirements as the models have their own internal logic, i.e. based on each model's premises, logical deductions are possible. Specifically, Foster's "Image of Limited Good" constitutes the requirement for a law in the explanas while in our systems model the explanas contains the specific postulated feedback channel between any two nodes. The explanas of both models contain antecedent conditions which specify the stimulus affecting the nodes in question. Because each model is based on its own internal logic (how the variables interrelate) and yet conforms to the rules of logic, the explanadum may be considered a very likely consequence of the explanas. Both models potentially enable empirical observations to be made for both the antecedent conditions and the explanadum, based upon given problems and the training of the social scientist.

The first three requirements, the degree of isomorphism, the
ability to predict, and degree of control are very much inter-related and based on the last three requirements. The first requirement is met by each model for in any given situation the proposed pattern of interrelationships has varying degrees of isomorphism with the real world. It is this author's conviction though that the systems model is more isomorphic to the real world than Foster's model. If we assume that the real world consists of patterned interrelationships of a mutual causal nature, potentially, a model that is also based on this assumption will produce a greater degree of isomorphism than one that is not.

From an anthropological perspective, a model that incorporates both emic and etic orientation, will be more isomorphic than a model that primarily emphasizes the emic or etic. (Cf. Harris (1968) who emphasizes the etic, to Taylor (1970) who emphasizes the emic and both with Pike (1954), Berlin (1968), and Kay (1968) who emphasize both the emic and etic.) The reason for this is that the emic/etic combination allows for a more encompassing framework involving a greater variety of nodes. Foster's model primarily focuses on emic relations while the systems model focuses on emic/etic relations and therefore includes more variables of a psychosocial-environmental nature. It is this emic/etic mixture that allows us to state that the primary function of friendship is not only to maintain the status quo, from an emic perspective, but also to keep the maximum number of people in the system due to natural
and social constraints, and etic perspective. The emic perspective of Foster is seen in the following passage:

"Tzintzuntenos probably are among the least change prone people to be found in a country as modern as Mexico. A large part of this inability and reluctance to change is due, as we have seen, to personality and social factors; village culture and society, reflecting life as finite, have conspired to produce a personality type which ensured the traditional community's viability. This personality is passive rather than active. The ideal man strives to be like his fellows, to stand out from them in no way, live at their level, share their poverty, avoid accumulating wealth for personal ends, endure leadership, refuse to actively participate in communal activities other than those associated with ritual" (1967:250).

The emic/etic perspective enables us to conclude that the reluctance to change is not solely due to personality and social factors, but that the environment of the system also plays an influential role. If the utilizable portion of the natural environment of the system is only capable of producing a finite amount of energy and to a great extent the social system is closed, then personality and social sanctions will develop to keep the system viable. The reluctance to allow change on an individual/family level is not due to emic organization, but is the only way the system may stay viable. We have seen that if one part of the system changes to the exclusion of the others, then eventually the system will destroy itself, for deviation amplifying feedback processes can destroy a system. The emic/etic perspective includes more nodes of a different nature and type and because of its organization, I therefore believe it is more isomorphic to the real
world of the peasant than is Foster's emic model.

If a model contains different types and kinds of nodes and postulates mutual-causal interrelations then the predictive power of this model will be more encompassing than a model that is organized around a single conceptual variable. Both Foster's model and our systems model are predictive but the probability (meaning the projected result will be demonstrated to be true; it will occur) associated with the explicit systems model is greater than the probability associated with Foster's model.

Foster's predictions are of a general nature as seen in his discussion concerning the "Reconciliation of Old and New Systems" (1967:316). Specifically, he predicts: "it is even possible that modern manifestations of the old system will take on increased importance" (Foster 1967:136). The justification being that (1) with the bracero program terminated, there will be a decrease in subsistence level and (2) village nationalism and increased feelings of unity stimulated by the Church will support the prestige-through-ritual expenditure pattern.

Utilizing our systems model in discerning what would happen if the bracero program terminated, we will approach the problem in the following manner: While the bracero program was in operation, over 50 per cent of the male villagers participated (Foster 1967:20), increasing the economic gain of the whole village. Through time
we may predict that this would result in the loosening of the
colleague and patron-client ties as the participants became
more independent, i.e. they developed a level of subsistence
which did not preclude their having to engage in loans and
debts to insure an adequate subsistence level as in the tra-
ditional system. Concurrently, the disease and malnutrition
levels would decrease because of the better subsistence and
potentially we would see a population increase. We may also
predict that the sanctions associated with religion would lose
their "leveling" potential. I believe religion would then be-
come more important to those of the "lower" class, for it would
offer a psychological structure for them to live within while
others were developing material possessions unattainable by the
lower class. What we would see develop is a class society based
upon those who participated in the bracero program and possibly
were able to continue in it for a number of years or developed
means to sustain their increased subsistence.

With the termination of the bracero program there will be a
general decrease in subsistence unless government loans and/or
new agricultural techniques are not introduced. I would predict
the following interactions: There will be a general increase in
disease and malnutrition with a consequent increase in the death
rate. A decrease in population will not increase the economy be-
cause the land is not capable of producing more food and the gen-
eral population has increased to the extent that food production
is still below subsistence level. I would also predict the 
re-establishment of colleague and patron-client ties for the 
same reasons as in the "old" system. We have, then, an in-
crease in disease, a decrease in population, a decrease in 
subsistence, an increase in envy producing situations, and an 
increase in colleague/patron-client type ties. I believe it 
is also logical to predict that this interaction network will 
stimulate the "old" role of the religious system even if the 
Church did not influence it. Until the system developed a new 
development amplifying subsistence mechanism for the whole village, 
the prestige-through-ritual expenditure pattern is the most 
likely interaction that will be able to keep people in the system 
when it is under stress. The underlying assumption is that the 
old religious patterns have not been out of use that long and they 
could be easily reactivated.

Utilizing the systems model the social scientist may predict 
what would happen if various combinations of problem solutions are 
simultaneously introduced (See Figure III). For example, what 
interactions are most likely to occur if health and sanitation 
measures are introduced to the exclusion of new agricultural tech-
niques or if all are introduced simultaneously? Or, what would 
happen if the bracero program were continued in conjunction with 
the introduction of health and sanitation measures with or without 
new agricultural techniques? This is what is meant by the concept 
of "play" introduced earlier in the thesis. This "play" factor
This diagram is a representation of the interactive process of problem solving. A-F are problems that occur within a system while 1-5 are solutions to problems A-F. Solutions 1-5 are simultaneously applied to problems A-F and the diagram represents the mix through time T-T7. For example, to achieve the desired condition, problem solution 1 is not as important after a period to time, T3-T5, as problem solutions 3 and 5. Therefore, more data is gathered dealing with 3 and 5 later in the change program producing the resultant mix in the Problem State chart.
indicates the greater or lesser degree of probability associated with various systems interactions. Through "play" the social scientist may determine which nodes and interactions are relevant and which are not (cf. Ashby 1970:102-103). Thus, when the social scientist makes a prediction, it is (1) the most probable of several alternatives or (2) consists of several alternatives of equal probability. Therefore, through utilizing the systems model, we may predict with greater accuracy the consequences of various stimuli simultaneously occurring in the system. As the system is processual, we may predict what will happen to the interactions if (1) they are left to themselves or (2) new stimuli are introduced.

One aspect of the predictive power of the systems model is its explicitness. Because the model is drawn and the interrelations of the variables are presented as arrows, it is possible for the social scientist to trace out the mutual causal interactions of various stimuli. The diagram then becomes another tool to enable the social scientist to further organize his thoughts.

With the ability to make more accurate predictions, the degree of control the social change agent has over the system increases. Control, as defined earlier, is (1) the determination of which variables are more critical in affecting outputs and (2) methods whereby the output is deliberately modified by the social scientist. Control in the psycho-social-environmental system will primarily center around information flow between nodes. In networks
specifically incorporating environment nodes, energy flow must also be considered. The basis for equating control with information flow or communication is that a system orients itself to the environment via transmissible messages (Westley and MacLean 1970: 77). McGrath (1970:312) has written that

"A group's communication structure may be considered as the set of possible or permissible communication links or as the pattern of communication channels actually utilized during group activity."

On a less abstract level, research has shown that the communication structure is influential to a given group task performance and the morale or satisfaction of the participants; concepts critical to planned social change.

The results of these experiments have been synthesized by McGrath (1970:314). He states the following two conclusions:

1. "For simple problems, centralized nets produce faster and more accurate problem solving than less centralized nets. The leader is happy in his central position but other group members are less satisfied. Individual satisfaction is directly related to the individuals centrality in the group. (How near he is to the central person in terms of communication links.)

2. "For more complex problems, performance differences among the nets tend to diminish. The effectiveness of highly centralized nets depends largely on the leaders ability and his utilization of members skills. The relationship between members satisfaction and member centrality however, tends to persist for the more complex problems."

Given that communication and control are closely related, the question is: how do we operationalize control via communication
channels for planned social change?

Foster (1967:293) believes that the innovators in the indigenous population are the basic key to understanding and introducing change. The assumption is that after the innovators have demonstrated the merit of a new technique, the rest of the population will follow. This is the belief of most anthropologists; the first innovations received by a community should be ones where the individuals decide for themselves and do not have to wait for a community decision. "most suggest building on the preexisting sense of individualism, rather than waiting for the emergence of a sense of cooperation" (Foster 1969:67). The result of this assumption is that the most important task of the social scientist is to determine the premises underlying the behavior of the peasants defined in terms of cultural, social, and psychological constructs (Foster 1969:120). Once one understands the cultural premises, one can identify innovations most likely to be accepted and then plan methods of presentation (Foster 1969:70).

For Foster the two most powerful cultural premises for behavioral change are the desire for economic gain and increasing prestige. He illustrates the above statement by concluding that for the people Tzintzuntzan, economic gain was the motivating factor in the development of new pottery forms and the resultant class of middlemen with highway stands to sell the pottery to the tourists. (The author believes that the development of the new pottery forms and middlemen by the system was because they were perceived as outside
the traditional economic system dictated by the limited good sanctions; they were perceived as similar to the bracero program—the wealth was from an external source, i.e. the increasing number of tourists. Thus, economic gain may be considered the motivating factor, but more importantly, the new wealth was not subject to the concept of limited good and therefore permitted. In any event, for Foster, the key to understanding change and especially planned change is that:

"innovative personalities. . . must be identified, aided, and educated, and they must be provided with an environment in which their ambition and desire for change can flourish" (1967:254).

"Real progress for innovative people can come only when they pass over a critical psychological threshold which permits them to ignore public opinion, to fail to carry out traditional obligations, and to enjoy the fruits of their energy and ability" (1967:121).

We would take issue with Foster on the methods of planned change for two reasons (1) the findings of Cartwright: (1970) and McGrath: (1970), and (2) predictions based on our systems model. In an earlier section of this thesis it was demonstrated that a sustained increase in subsistence by members of the system put the remaining members of the system in a more precarious position. This was due to the interaction of subsistence and friendship ties; with an increase in subsistence there is more independence. This leads to the development of a new peasant class that is sustained by outside inputs (bracero earnings, government loans and agricultural recommendations for agricultural improvement). We believe that
greater emphasis on innovators and not on the whole group will produce more strains for those people who are not innovators because they will be more confined by the system and the majority will not be better off. This is not stating that harmony is the desired end but that strains should not be introduced that are potentially maladaptive to the system.

It has been demonstrated that to a great extent the group controls the behavior of individuals. For example, when a specific group decided to change its own behavior, it was 2 to 10 times as effective in producing actual change than was a lecture system trying to induce change (Cartwright 1970:323). It has also been demonstrated that the productivity of work groups is increased by methods of organization which give more responsibility to the work groups. The proposed reasons for these results are that more participation in important decisions concurrently produces more stable groups which in turn provided a firm basis for the support of individuals needs (Cartwright 1970:324). Cartwright (1970:325) presents evidence that contradicts Foster's emphasis of the innovators to the expense of the group. Specifically:

"those who had been trained in isolates were only slightly more active than before the workshop whereas those who had been members of strong training teams were now much more active..."

"For the isolates the effect of the workshop had the characteristic of a 'shot in the arm' while for the team member it produced a more enduring change because the team provided continuous support and reinforcement for its members."
McGrath (1970) presents evidence that group task performance and interpersonal relations are better under conditions of "facilitative interdependence" the participants are independent but gain the best rewards if they work together. This organization is opposed to contrariant interdependence where the more one member gains, the less the others can gain. In this situation the motivational conditions foster competition among group members (McGrath 1970:308). Tzintzuntzan may be characterized as possessing contrariant interdependence and therefore the change we would like to induce is facilitative interdependence. Facilitative interdependence would not go against the sanction of limited good or established a class boundary through competition. What it would accomplish is change on the group level.

To make constructive use of group pressure it must be used as a medium of change. Cartwright (1970:326-329) lists eight principles which facilitate group change and which this author believes are applicable to Tzintzuntzan:

1. "If the group is to be used effectively as a medium of change, these people who are to be changed and those who are to exert influence for change must have a strong sense of belonging to the same group . . . (cf. Foster 1969:Chapter 5, The Interaction Setting who also advocates this principal)."

2. "The more attractive the group is to its members the greater is the influence that the group can exert on its members . . ."

3. "In attempts to change attitudes, values, or behavior, the more relevant they are to the basis of attraction to the group, the greater will be the influence that the group can exert upon them . . ."
4. "The greater the prestige of a group member in the eyes of the other members, the greater the influence he can exert. . ."

5. "Efforts to change individuals or subparts of a group which, if successful, would have the result of making them deviate from the norms of the group will encounter stormy resistance. . ." (See the above discussion dealing with the training of innovators and the effect this has on the system.)

6. "Strong pressures for changes in the group can be established by creating a shared perception by members of the need for change, thus making the source of pressure for change lie within the group. . ."

7. "Information relating to the need for change, plans for change, and consequences of change must be shared by all relevant people in the group. . ."

8. "Changes in one part of a group produce strain in other related parts which can be reduced only by eliminating the change or by bringing about readjustments in the related parts."

The following organization is proposed by this author to operationalize planned change utilizing concepts presented in Foster, Cartwright and the systems model, (See Figure III). The goal is change by and of the group with innovators utilized in the capacity of group coordinators or liasons between the group and the change agency. The first task will be to determine what problems the indigenous population perceives and what problems the social scientist perceives (or the change agency). The goal is to determine (1) in what ways are the problems different, similar, and why; (2) how may we integrate the problems into a common system to determine mutual causal interaction and (3) how does one prevent
adverse effects either to the indigenous population or to the change agency. The choice of which problems to work with first are ones in which the indigenous population will derive satisfaction when the problem is solved. In this manner (principle 2) the group gains attractiveness for the members to stay involved and becomes attractive to nonmembers to join (principle 3). The specific operationalization involves the determination of innovators in the indigenous population and integrating their leadership with learning by the group. Both are receiving information of the same type but the intensity and frequency of information to the innovators is greater than that to the whole group. The innovator is never taken from his indigenous system and is in continual contact with the other group members who are also receiving information. We are trying to increase principles 4, 6, 7, 3 and 2 while trying to prevent principles 5 and 8.

In any given community there will be problems that effect various groups to different degrees. Thus the innovator for each group may be different; an innovator in one group may be a member in another and not involved at all in a third group. The concept of innovator is not homogeneous but heterogeneous in that it is group specific; a person may be innovative in one area and not another. It may be diagrammed as follows:

The participants are involved in more than one task but the leader is different for each task and not separately trained.

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As each group is organized around a different problem and not all people are involved in each group, the information for the change agent will have to be group specific. The communication will involve questions of type of information, intensity of information, the frequency of information and the use of the group innovator (coordinator) to decrease the "noise" between the change agent and the group. If these questions are not dealt with, the desired result of introduced information concerning a given goal will become less probabilistic and may result in group interrelations that are detrimental to both the group and the future of the change agent in the community.

Presently, I believe there are four primary reasons for emphasizing change on the group level. First, by emphasizing group level change, one does not incur traditional sanctions associated with an individual or family participating in deviation-amplifying processes. The system assumes a steady state in which various groups change at a greater or lesser pace, but all are changing in relation to each other, none are static. The second reason involves the use of innovators. By concentrating more information in one individual than in the whole group and having that one individual disseminate the more complex information in terms more understandable to the group I am assuming fewer questions concerning comprehension would occur. Also, this method of organization is more expedient in terms of information flow and feedback (See Westly and MacLean, 1970:73-82 esp. ABX model page 77.) Again,
I emphasize that information is being input to both the innovator and the group based on principle 4 concurrently operating with principle 5, the prevention of strong resistance based on increasing autonomy. The third reason deals with the diffusion of leadership throughout the community, a person is not more than one group leader. Because information is flowing to all participants, those who are leaders are not singled out to the extent that they would be if they were the only ones receiving information. Therefore, the sanctions against assuming leadership roles may not be employed to the extent they would be by traditional standards. (cf. Foster 1967:133). The fourth reason is that our method of group level change follows eight principles which have been demonstrated to facilitate humane group change.

Foster's method of planning change and our method of planning change can also be evaluated in terms of goals that are presently external to any given system. This involves the reason of why planned change must occur. For Foster planned change must occur so that the peasant can be accommodated to newly industrial societies and find a functional role. This involves the learning of the need for surplus (planning ahead), competition for economic gain, and the values of capitalism. It is a change that further accentuates the individual as opposed to the group. Our reason for believing planned change must occur centers on the idea that there are limits to material growth and these limits will be reached in the not too
distant future (Meadows 1972; Watt 1972:57). We see community development programs via cooperation, not competition, as the method of achieving a steady state. Hence, our emphasis on group change and not just individual change. It may be argued that any limits to growth will occur in present industrial complexes before occurring in newly industrial complexes such as those with which peasants are associated. Therefore, are the concerns relevant to peasant societies? The point is that they will occur to newly industrializing societies and therefore it seems logical and humane to try and develop alternatives other than competition and capitalism as ways of improving humanity's standard of living. The methods of change we have discussed concerning peasants should have an analogous program in the urban centers of world population concentrations. Both have to change or neither will survive.
CONCLUSION

This thesis has been an attempt to present a framework in which complex human behavior may be dealt with and understood. The thesis has advocated the adoption of a relational and not a classificational view of nature. It considers humans to be systems and part of systems involved with and in psychosocial-environmental matrices. Human systems are considered to be open organizations exchanging information/energy with themselves and their environments.

There are two general areas of knowledge in which the systems perspective may influence our cognitive organization and perception. On one general level it facilitates the organization of knowledge from various disciplines, it enables the determination of gaps and inconsistencies in our present state of knowledge and enables the generation of new knowledge while working with concrete, real world situations. On the other general level, when utilizing the systems approach we consider pertinent those experiences and observations based on a relational, interactional frame of mind. This enables us to entertain various hypotheses dealing with development and change and incorporate them into a relational universe.

The concept of open systems provides a scientific framework for the study of the uniqueness of the individual and his self-
determination. The relational perspective considers it axiomatic that individuals make choices and decisions within their own cognitive organization. The concept that enables one to study individuals, groups, or organizations and their arrival at decisions is equifinality, the attainment of a common goal via various means. The systems framework in conjunction with equifinality provides an emic analysis from the perspective of the individual and an etic analysis from the perspective of the psycho-social-environmental interaction. Systems theory gets at "the full complexity of interacting phenomena—to see not only causes acting on the phenomena under study, the possible consequences of the phenomena, and the possible mutual interactions of some of these factors, but also to see the total emergent processes as a function of possible positive and/or negative feedbacks mediated by the selective decisions or 'choices' of individuals and groups directly or indirectly involved. No less complex an approach can be expected to get at the complexity of the phenomena studied" (Buckley 1967:80).

As systems theory provides a perspective to view the real world, it also provides a strategy or methodology to change the world. We have stated that the concept of systems is understood as relations inner connected by information/energy flow. This has relevance for change agents as they must deal with information/energy and communication nets of the people who will be the recipients of the change. The key to directed change is an understanding of the communicatory processes. Looking upon change as the result of the transmission of information/energy in or to a system there are four primary questions we may ask of the system

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in order to begin to understand its communication processes. The first deals with system inputs; what constitutes the systems inputs, what are the kinds of information/energy currently utilized, and what inputs are available in the environment; secondly, how is the input processed—what are the constraints of the system (deviation counteracting) and what are the deviation-amplifying networks, how do these influence the decisions made; thirdly, what is the systems output—what decisions are made; and lastly, what is the result of the output when it is fed back into the system over a period of time, i.e. how are 2 and 3 altered? Once these questions start being answered, the change agent can begin to propose a system of interrelationships abstractly representing reality. As the system operates via information/energy flow, we consider it open, probabilistic and exhibiting the concept of equifinality. On paper this allows the change agent to theoretically intervene simultaneously in more than one network and predict the results of various intensities and combinations of different inputs of information (see Figure III). He can begin to answer questions such as, with a specific goal and X number of routes to the goal, which is the most disruptive to the people, which will facilitate the greatest amount of change, which is the most humanitarian, etc.? The concept of general systems enables the change agent to consider whether propositions about the systems behavior at another level of abstraction may be used to guide the strategy of intervention at the level he is presently dealing with.
If further enables him to determine how much information input (control) is necessary for each strategy to succeed. All this enables the change agent to predict the outcomes of various strategies before they are tried in the field. The systems approach for planned change:

"leads to a diagnostic approach that has a large view of symptom or problem behavior and avoids unidirectional cause-effect thinking; it requires a synthetic rather than piecemeal analysis that focuses on the study of relations rather than of entities per se; it facilitates the formulation of alternative solutions to problem situations, the identification and selection of appropriate points for intervention and permits a wider scope of change strategy and innovative techniques" (Stein 1971:157).

I see a required shift from classificational orientation to a relational orientation as we are dealing with systems and thus relations and not classifications. A particularistic orientation has to be replaced by a processual framework with the realization that parameters are heuristic devices proposed by the observer. For these reasons, I consider systems theory as presented in this thesis as a potential problem solving alternative. Through an examination of behavior via information flow, feedback and learning, and the systems paradigm, we potentially will be in a position to propose a solution to problems in a more meaningful manner.
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APPENDIX I

Envy
"Envy" will be considered to be a desire to acquire something possessed by another Foster (1972:168). It may be viewed as a conscious or subconscious emotion which may lead to violence and destruction. The main stimulus for envy is the betterment of position by a peer who incurs the envy of those who consider themselves less fortunate whether psychologically or physically. Foster (1972:169) states that food, children, and health are most likely to induce envy. Thus, at various times ego is involved with two varieties of envy, he may fear the envy of others for what he has, or he may fear being accused of envious acts. Both will cause ego psychological distress and influence him to remedy the situation.

Psychological fear
I will consider the definition of psychological fear to be mental events which deal with worries and dread about the future, friendship, machismo, subsistence and health. Ego's psychological state will depend on, and influence, the above listed nodes; and thus will be relative to their influence and intensity. I am assuming ego will have as a potential goal, the elimination of psychological fears, as they are a function of other aspects of the system, some of which ego may have control over.

Psychosomatic illness
I will consider psychosomatic illness to be a node in any network which causes ego to develop disease resulting from distressed mental frame of reference. This would include the development of ulcers, death from malnutrition induced by the fear and consequent acceptance of witchcraft (voodoo death) and types of skin disease. Consequences of psychosomatic illness will be considered more severe and intense than psychological distress which may not develop into psychosomatic problems.

Machismo
Machismo is defined as one's manliness, authority, respect, and honor in relation to one's conception of himself and how others perceive him. A man is a macho if he is "a valiant man, is one who is strong and tough, who is able to defend himself and his family, who doesn't seek quarrels but who doesn't dodge them if forced upon him." Foster (1967:131). I will consider prestige to be an aspect of machismo as an increase of prestige will increase ones respect and honor.

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Folk Medicine
Folk medicine will be considered any act by a shaman or Curandero to alleviate emotional or physical illness. Specifically the nullification of the evil eye, some aspects of witchcraft, and the curing of illness of those who cannot afford doctors or for other reasons don't partake of their services. A Curandero would be consulted if any strong emotional experience such as fright, jealousy, envy, anger, pleasure, or embarrassment occurred which the villagers believe may cause illness (Foster 1967:188-193).

Malnutrition
Following Funk and Wangls (1968), malnutrition is defined as "faulty or inadequate nutrition; undernourishment."

Disease
We shall utilize Funk and Wangls (1968) definition of disease: a condition of ill health or malfunction in humans; a disordered physical condition or process having particular symptoms and affecting the whole or part of the individual involved.

Population
Population will be defined as the number of consanguin members that are associated with ego's family at any one time. Thus, a birth or death will increase or decrease the population respectively. Unless noted, population will not refer to the total number of occupants in the village at a given time.

Religion
The religious system we are concerned with, the "Mayordomia" is the "ceremonial sponsorship by a person or small group of people of an image or a church building or chapel, usually for one year" Foster (1967:195). The traditional system involved 7 cargos (Foster 1967:197) that a person advanced through, each one consuming more wealth but resulting in the acquisition of more prestige. The people involved in a mayordomia were not volunteers but were elected by village vote and consent. Once chosen, it was impossible to refuse the office. Openings in the mayordomia system were such that those who had gained wealth would have it drained off. The conspicuous consumption underlying the system led to prestige and the increasing of machismo; the system permits a man to show publically that he conforms to the ideal man. Thus one of the functions from the peasants vantage point was to help one's children gain respectability by having a father who was respected.
Patron-client (Foster 1965:216-218, 227-233)

Patron-client ties consist of two partners, one occupying a higher socio-economic position. A patron ... is someone who combines status, power, influence, authority – attributes useful to anyone – in defending himself or in helping someone else to defend himself." (Foster 1965:288) The partners recognition of mutual obligations validates the system which is based on the exchange of different types of goods and services. The interactions are short term and not continuous. The contract between two people does not exist until a request has been granted and cancelled after the supplicant complies with the vow (Foster 1965:229). These relationships provide the lower socio-economic partner with advice and security in life crisis such as illness, sudden need of cash, help in legal disputes, and protection from exploitation, (Foster 1965:229-230). "Within the village, local colleague ties provide a man with all he needs, at peak periods of demand of the kinds of goods and services to which he himself also has access. The patron's utility lies in the fact that he can provide things not normally available in the village, things that at times are badly needed." (Foster 1965:231-232).

Colleague

Colleague relationships interrelate people of equal or approximately equal socio-economic positions who exchange the same kinds of goods and services (1968:217). This reciprocity is expressed in continuing exchanges of tangible goods which are kept in relative balance but never equal as this would sever the contract.

A special type of colleague tie is bonded by the compadrazgo: "the ritual sponsorship of a person or persons by another person or persons, with consequent formal ties among a number of people, which last during the life times of the participants" (1967:76). The compadrazgo is the most sacred of all relationships as each participant treats the other with respect and formality.

There are five traditional occasions for establishing these types of ties: the baptism of a child, confirmation, first communion, marriage, and de la corona. The partners are selected on the basis of long association and common interests as the majority of all the participants are of the same socio-economic status. The partners (or compadres) do not repeat but new ones are established (a different set) for each of the above five occasions. On some occasions the ties are extended to the relatives and compadres of one's own compadre so that one has the ability to develop many ties.
Economy
We are defining the economy of Tzintzontzan as the standard of living per household. In general, the economy is in a precarious state with a very narrow economic margin over basic subsistence. On the village level pottery selling constitutes 55% of the occupations with farming providing 39%. Land is in very limited supply, thus cattle and pigs, not agriculture, are the largest source of ready cash in an emergency (Foster 1967:46). Factors outside the traditional peasant system which effect the economy are tourism, government loans and agriculture advice/techniques, government sponsored health services and bracero earnings.

Pottery making
The process of pottery making is described by Foster (1967:41-43). Women assume the major role in pottery making and used to do the majority of the financial transactions presently handled by middle men (Foster 1967:61-62). The role of the men is to gather the firewood for the kiln and collect the pottery clays. With the increase of tourism, new forms of glazes and shapes are appearing.

Agriculture
The primary crops are maize, beans, squash, and wheat. The plowing is done with oxen and the sowing is usually done with a friend (compadre). Traditionally the farmers are dependent on rainfall for maturing crops (Foster 1967:43-44).

Bracero experience
The bracero is a man who has been an indentured farm laborer in the U.S. for a period of 2 to 6 months. In general, economic gain is a major factor in wanting to be a bracero as one earns more than at home and it means economic improvement (Foster 1967:276). The money earned is not considered envious because all the men have a chance to be chosen and luck is seen as the determining factor. Therefore the money is outside the concept of limited good and thus not effected by any sanctions. The bracero may achieve enough capital to break out of the system but many return to old ways. New ideas are present but depending on the individual, not always utilized.
Appendix II

1. Economy — — Envy
This feedback encompasses two possibilities; first, a decrease in ego's economy will increase his envy towards those more fortunate, thereby threatening them (Foster 1972: 32; 1956b:312), or with an increase in ego's subsistence level, his envy of others will decrease as he is more secure and less threatened by a stringent economic situation (Foster 1965b:313).

2. Economy — — Envy
I have postulated that an increase in ego's economy will increase the envy of others toward him. Foster has written (1967:153) that the "betterment of position is likely to arouse the envy of those who consider themselves less fortunate". For example, if one is seen eating he may arouse the envy of his/her observer who may not have enough to eat (1967:162; 1972:30). For further discussion of the relationship between increasing one's economy and accruing the envy of others (See Foster 1964:39-44; 1965a:25,26; 1960-61:174; 1972:169,171).

3. Religion — — Envy
I am concerned with one aspect of this postulated interaction, that an increase in ego's religious obligations will decrease the envy of others towards him. The proposed reason is that concurrently, ego's economy is also decreasing (number 37). (See Foster 1965b:314; 1965a:34; 1972:179).

4. Population — — Envy
I have postulated that an increase in population, i.e. a new baby in the household may incure the envy of others as babies are considered desirable. A baby indicates that one's economy is substantial and that when the child matures, additional necessities of life will become possible (Foster 1966:56; 1967:158; 1972:169;1960-61:175-177). A justifiable hypothesis to be tested is that if a family cannot or does not have children, they will envy any family with children. This hypotheses would not include families with one or two children. While they may be envious for a short period of time, this envy will not be as intense as the families without children.

5. Disease — — Envy
This feedback interaction postulates that if ego is ill, he may envy those who are well as they are not suffering or incapacitated. An increase in disease may potentially decrease ego's economy (Foster 1972:169).

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6. Malnutrition → Envy
   I am proposing a justifiable hypothesis which postulates that an increase in malnutrition may increase the envy of the person afflicted. This is because he will be physically weaker and not be able to provide for his family to the extent of physically stronger people. The person may therefore become envious of the more healthy people.

7. Envy → Psychological fears
   The postulated feedback includes two different interactions. If there is an increase in the envy of others towards ego, ego's psychological fears of harm may become more intense. This involves fear of what people will say (Foster 1967:96, 121; 1965a:26), fear of the envy of others (1967:154; 1960-61: 175-177) and fear of physical aggression (1965a:26, 1972:171). Contrariwise, a decrease in the envy of others toward ego will decrease ego's psychological fears as he will not fear what people say or possible physical aggression.

8. Colleague → Psychological fears
   This feedback interaction postulates that increased or stable colleague ties will decrease the psychological fears of the participants, for they may depend on their colleagues to help them in time of need (Foster 1961:1188) and everyday living (Foster 1967:43).

9. Patron-client → Psychological fears
   This feedback interaction is very similar to number 8. If ego has strong patrons, his psychological fears of not being able to get help in time of need are decreased. This feedback interaction also indicates that few patrons may stimulate ego's psychological fears as a reliable insurance mechanism is not available (Foster 1961:1963).

10. Disease → Psychological fears
    If there is an increase in illness this may increase ego's psychological fears as he may not be able to provide for his family or afford proper medical treatment (providing it is available and he will avail himself to it (Foster 1961:233). Contrariwise, if ego is healthy, this may decrease his psychological fears dealing with his families economy. He does not forget disease but is presently not concerned with it (Foster 1967:185-193).
11. Psychological fears → Psychosomatic illness
This feedback postulates that an increase in psychological fears may stimulate psychosomatic illness. Fears of the evil eye (1965a:28) and worry in general may stimulate the development of ulcers, nervousness, and other psychologically based diseases (1967:191). With a decrease in psychological fears, I am postulating that the development of any psychosomatic illness will be much less probable.

12. Envy → Psychosomatic illness
I am postulating that an increase in envy may result in the direct stimulus of psychosomatic illness by-passing feedback number 11. This occurs when aquasations of witchcraft are made (1972:172; 1965a:26) or fear of the evil eye. The folk illness in children called chirpil results from the evil eye caused by envy (1972:174). In general, ego may explain his ill health as the result of envy which stimulated psychosomatic varieties of illness (1972:174). The opposite effect would be that a decrease in envy will decrease any psychosomatic tendencies toward illness (number 11).

13. Psychological → Machismo
This feedback interaction postulates that a decrease in psychological fears may enhance ego's machismo as he is presently more confident. For example, the reader can trace an increase in economy as stimulating ego's machismo following feedback channels 1, 7, and 13 or 22 and 14 (See 1963:1280 and 1965b:313). Contrariwise, an increase in psychological fears may potentially decrease ego's machismo.

14. Malnutrition → Machismo
This postulated feedback interaction states that a decrease in malnutrition may cause an increase in machismo. This is because ego is physically stronger and thereby more able to provide for and defend his family against any type of distress. The opposite feedback interaction states that an increase in malnutrition may cause a decrease in machismo because of the opposite effects of the above reason.

15. Folk Medicine → Machismo
This feedback is considered a justifiable hypothesis which states that an increase in folk medicine may cause a decrease in machismo. The reliance on folk medicine indicates that a person is weak (physically or psychologically) and thus their machismo or, indications to others of ones machismo, will decrease.
16. Psychosomatic illness ---+Folk Medicine
This feedback postulates that an increase in psychosomatic illness may cause the person to rely on folk medicine for a potential cure. Attacks of the evil eye or witchcraft may only be cured or counteracted by a Curandero (Foster 1967:270). The child illness chipil, caused by the evil eye can only be cured by folk medicine (Foster 1972:174). The opposite feedback is that a decrease in psychosomatic illness will cause a decrease in folk medicine.

17. Disease ---+Machismo
This feedback postulates that an increase in disease may cause a decrease in machismo. Foster (1965a:28) writes that sickness may cast doubt on machismo, as physical and psychological defenses are weak and in relation to those of a healthy person (1967:158). The opposite feedback is that a decrease in disease may cause an increase in machismo as ego is healthier and more able to defend himself and his family.

18. Population ---+Machismo
This feedback postulates that an increase in population will increase ego's machismo. Healthy offspring are the best evidence of machismo (Foster 1967:158; 1965a:28) as they demonstrate that ego has a substantial economy which enables him to increase his family size. Contrariwise, a decrease in population may decrease ego's machismo as it may indicate that he was not strong enough to defend his family from disease.

19. Religion ---+Machismo
The postulated feedback is that an increase in religion will stimulate an increase in machismo. By sponsoring a mayordomia, ego gains much prestige. Consequently ego's machismo increases as he presents a strong image to his fellow villagers (Foster 1967:205).

20. Malnutrition ---+Folk Medicine
The feedback mechanism postulates that an increase in malnutrition may cause an increase in folk medicine. This is because Curanderos tend to treat villagers who can't afford doctors (Foster 1967:270). I am assuming that malnutrition indicates an economy which is without the surplus to spend on doctors either in kind or money.

21. Disease ---+Folk Medicine
This feedback postulates that an increase in ill health may stimulate an increase in folk medicine. The reason is that ego will first consult the Curandero before going to a hospital or doctor (Foster 1967:271).

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22. **Economy** → **Malnutrition**
This feedback postulates that an increase in economy may prevent malnutrition from occurring in ego's family. The feedback is based on the assumption that with an increased subsistence level, in general the people will be eating better and be more healthy. The reverse situation is when there is a decrease in the subsistence level and a resultant increase in malnutrition.

23. **Disease** → **Malnutrition**
The postulated feedback states that an increase in disease may cause an increase in malnutrition. The reason being that if ego is sick for a prolonged period of time, he will not be able to sustain his level of subsistence, potentially causing an increase in malnutrition. Associated with disease, a lack of sanitation and hygiene interacting with disease may cause an increase in malnutrition (Foster 1965b:309). With a decrease in disease, ego will be healthier and we may assume there will be a concurrent decrease in malnutrition.

24. **Malnutrition** → **Disease**
This feedback states that an increase in malnutrition will cause an increase in disease for biological and physiological reasons.

25. **Folk Medicine** → **Disease**
This feedback postulates that an increase in folk medicine may stimulate an increase in organic disease. Folk medicine sometimes delays the patient in getting to the hospital, thus making the disease worse than if the patient had come in earlier (Foster 1967:270-71). The opposite effect would be that potentially a decrease in folk medicine would cause a decrease in serious illness as one may assume hospitals would be used more frequently.

26. **Psychosomatic Illness** → **Disease**
The postulated feedback is that an increase in psychosomatic illness may cause an increase in disease. The villagers believe that strong emotional experiences such as fright, jealousy, envy, anger, pleasure and grief may cause illnesses (Foster 1967:191; 1972:174). The other effect is that a decrease in psychosomatic illness will cause a decrease in disease.

27. **Economy** → **Disease**
This feedback postulates that an increase in economy may cause a decrease in disease. The primary reason is that bracero earnings provide for better housing and thus a healthier place to live (1967:30). Also, with an increase in the economy, ego is most likely to be eating better, see #22. Contrarily, a decrease in the economy may cause an increase in disease.
28. Population — + — Disease
   This feedback interaction is classified as a justifiable hypothesis as an increase in population on the village level may cause an increase in disease. The reason for suspecting this assumes that physicians are not available and living conditions become worse (see #27).

29. Disease — — Population
   This feedback postulates that in increase in disease may, on the village level, cause a decrease in the population of various families. The reason is that with members of the family sick or weak for an extended time period they may not be able to reproduce and eventually die. This assumes that a decrease in the economy prevents ego from seeking a doctor's help (Foster 1972:169; 1967:158).

30. Psychological Fears — + — Religion
   The interaction between psychological fears and religion postulates that if ego's psychological fears increase, this may increase his religious activities (Foster 1965a:26; 1965a:34; 1965b:314). The justification for this interaction is that ego's psychological fears are the result of envy (#7) and one method of decreasing this envy is through the mayordomia religious system.

31. Psychological Fears — + — Patron-client
   This feedback postulates that an increase in psychological fears may stimulate patron-client ties. The reason is that the patron-client tie will provide ego with assistance when ego has a problem that cannot be alleviated by relying on colleagues (Foster 1961:223). Contrarily, with a decrease in worry, ego's patron-client ties are not activated but nevertheless are available.

32. Economy — — Patron-client
   This feedback indicates that when ego has an increase in economy, his reliance on patrons may decrease. The reason involves the assumption that ego may have enough surplus to provide for any emergencies and thus decrease his reliance on patrons. The other situation is a decrease in ego's economy may stimulate patron ties as ego may have to rely on his patrons for financial aid.

33. Population — + — Colleague
   This feedback postulates that an increase in ego's affinal relations will increase his colleague connections by means of compadrazgo ties (1967:77; 1963:1283). With a new baby to care for, new patron-client ties provide security for the babies' care in case of an emergency.
34. VOID

35. Psychological Fears ———— + ————→ Colleague
This feedback assumes that an increase in psychological fear may stimulate a greater reliance on colleagues. Thus, if ego needs help that can be satisfied by intravillage ties, he will rely on his colleagues to provide this help (Foster 1961:223). With a decrease in psychological fears, there is a decrease in the critical need for colleagues and relations will be more normal (Foster 1967:217-227).

36. Economy ———— - ————→ Colleague
This interaction stipulates that with a decrease in ego's economy, his colleague ties may increase. The reason is that ego may borrow from his colleagues in times of need until his own economy increases (Foster 1967:115). The reverse situation is that ego's economic situation increases and thus his reliance on colleagues may decrease (1967:217-227, 307). This is because ego is economically better off and less dependent on others.

37. Religion ———— - ————→ Economy
This feedback postulates that an increase in ego's religious activity (mayordomia) will decrease his economic surplus (Foster 1965a:26). The reason is that the expense of sponsoring a mayordomia will deplete ego's economic surplus relative to that of the rest of the villagers (Foster 1967:194-211, esp. 209).

38. Population ———— - ————→ Economy
This feedback is a justifiable hypothesis which states that an increase in population may cause a decrease in ego's economy but increase his economy over an extended time period. The reason being that the expenses of a baby decrease ego's economic standards until the child can become an economic contribution (Foster 1972:169; 1967:268).

39. Disease ———— - ————→ Economy
This feedback postulates that an increase in disease may cause a decrease in economy. The prime justification is that poor health may make food production impossible (Foster 1972:169). Concurrently, poor health necessitates that ego seek cures and this results in a decrease of his economic security (Foster 1965a: 32; 1961:223; 1967:46). The contrast would be that a decrease in disease may enable ego to work regularly and thus the economic standard remains substantial.
40. Psychosomatic Illness ——> Economy
This is a justifiable hypothesis which postulates that an increase in psychosomatic illness may cause a decrease in the economy. This interaction would manifest itself in ego's development of ulcers of analogous diseases and thus decreasing his ability to work. The opposite effect is that a decrease in psychosomatic illness may sustain an increase in economy as ego will not be preoccupied with fears.

41. Agriculture —— + ——> Economy
This feedback interaction states that an increase in agriculture increases ego's economy. Conversely, a decrease in agriculture, decreases ego's economy (Foster 1967:162). This is applicable whether ego has a surplus to sell or is eating better.

42. Livestock —— + ——> Economy
This feedback stipulates that the utilization of livestock increases ego's economy. Livestock is utilized to pay debts when emergencies arise as it is the largest source of ready cash (Foster 1967:46).

43. Pottery Making —— + ——> Economy
This feedback stipulates that an increase in pottery making (for sale) will cause an increase in the economy. It is very similar to #41.

44. Land Production —— + ——> Agriculture
This feedback indicates that an increase in land production will cause an increase in agriculture and conversely, a decrease in land production will cause a decrease in agriculture.

45. Population ——> Land Production
This feedback indicates that an increase in population on either the village level or for ego's individual family will decrease the lands productivity. Increased demand depletes the agricultural potential of the land because there are more people to feed per unit of land (Foster 1967:280; 1965b:306). The opposite effect is that in the long run, a decrease in population will increase land production because the demand per unit of land will decrease.

46. Physical Environment —— + ——> Land Production
This feedback stipulates that if the physical environment is satisfactory i.e. enough rain, stable water level, etc.; the land production will stay the same or possibly increase. If for any reason the physical environment deteriorates, then land production will decrease (Foster 1967:44).
47. Livestock ——— Physical Environment
   This feedback stipulates that any increase in the number of livestock in the surrounding hills may potentially deteriorate the physical environment by over grazing. (1967:3)

48. New Techniques ——— Land Production
   This feedback interaction indicates that the adoption of new farming techniques will potentially increase land production.

49. Fertilizer ——— Land Production
   This feedback postulates that the use of fertilizer will increase land production if used in the proper manner (Foster 1967:262).

50. Tourism ——— Pottery Making
   With an increase in tourism, we postulate that there will be an increase in pottery making and sales (Foster 1961:177). There has been an increase in new types of pottery (glazes, wares) and pottery stands along the road (Foster 1967:282-83, 305).

51. Bracero ——— Economy
   The bracero experience has greatly influenced all parts of the system as the earnings have provided better housing and thus a healthier place to live (Foster 1967:30). We are postulating that an increase in bracero earnings will increase the economy because the motive for becoming a bracero is primarily economic (Foster 1967:237-277).

52. Government Loans ——— Economy
   This feedback, an increase in government loans stimulating the economy, is, along with #51, the greatest factor in providing monetary changes in ego's economic situation (Foster 1967:286).

53. Hygiene ——— Disease
   This feedback suggests that an increase in hygienic practices introduced by government health officials may decrease the disease factor in the Tzintzuntzan system. The reason being that hygienic practices will retard the spread or severity of diseases i.e. ego may still get sick but possibly not as severely as before the introduction of hygienic methods (Foster 1967:259-261).

54. Immunization ——— Disease
   This feedback postulates that an increase in the immunization, specifically of children, will decrease the disease rate in Tzintzuntzan. For specific changes in the decrease of disease due to immunization, see Foster (1967:271-272).
55. Sanitation ——→ Disease
This is a logical interaction which postulates that an increase in sanitation may cause a decrease in disease. The reason being that environmental sanitation will decrease the number of disease bearing insects (Foster 1967:246).

56. Machismo ——→ Psychological Fears
This feedback is a justifiable hypothesis which states that an increase in machismo may decrease ego's psychological fears. The reason is that ego may have increased his prestige and thereby his well-being in terms of his peer group. This interaction indicates that ego feels more secure and more able to cope with the system for the period of time. Contrariwise, a decrease in machismo will increase ego's psychological fears.

57. Agriculture ——→ Physical Environment
This feedback indicates that an increase in agriculture will decrease the potential of the physical environment. The reason being that nutrients will be taken out of the soil and not replaced (Foster 1965b:306).