CULTURAL SYSTEMS AND ORGANIZATIONAL PROCESSES:
OBSERVATIONS ON THE CONFERENCE PAPERS
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All of these papers share a concern with producing analyses of culture that are comprehensive and internally coherent. All agree with van der Leeuw that formalization can be used to achieve this. All assume that such analyses will be more than mere categorizations or remote analogies and will help expose the inner dynamics of culture. Though there is a common commitment to formalization as a basis for descriptive precision, nonetheless there is disagreement over what is being described.

Over the past century most ethnologists have assumed that the most basic empirical question regarding culture is: What is it? These papers ask an even more basic question. Is culture one thing or system, or is it or several things or systems of different kinds? Just three of the papers assume that culture is one kind of thing that makes up one system which can be represented by one kind of formalization. All the rest assume that it consists of several different kinds of things and different systems that must be represented by distinct formalizations.

The papers that assume culture is one kind of system are those by Jorion, Ballonoff and Ezkhova. Each does so, however, in a different way. Jorion's article is mainly about theoretical physics, as he sees it, in general terms. He does not develop an idea of culture except as a general heading under which one puts what people do. He ties his view of physics to culture only with seemingly opportunistic examples: language, an army marching, and the notion of environmental carrying capacity. Since language is associated with creating action at a distance, he argues that it should be analyzed with the idea of a field. An army marching may be analyzed as a beam since its footsteps have possible harmonic properties. Environmental carrying capacity is discussed in terms of "pressure" leading to "fission." However, the links Jorion makes to physics are not through physical analyses but physical metaphors, thus his is an argument by analogy. It therefore depends on the strength of the presumed analogical relationships. This strength is not always self-evident. The influence of a field, for example, is a direct exponential function of distance. That of language is not.

Ballonoff also takes culture as a given and rather than defining or describing it he begins with the idea that culture is transmitted and focusses on the conditions for its transmission. He assumes that this transmission inevitably involves kinship relations since we are all born of parents. On this basis he offers a neat formalization of intergenerational transfer using ideas from set theory. He further suggests that this mathematical structure actually influences what can be transmitted through it, including actual marriage rules in the ethnographic sense.

The problem with this is not in the formalization but in the empirical claims it is taken as representing--in two ways. The first is that while it is doubtless true that kinship relations are important for the transmission of kinship ideas, kinship ideas are not the only ideas that make up culture and other ideas have very different types of organizations through which they are transmitted: political ideas through political organizations, scientific ideas through scientific organizations, economic ideas through economic organizations, and so on. This is precisely what Fischer in his article on Classification and Symbolic Representation (Fischer, 2002) is calling attention to, and what Lyon's

paper in this volume illustrates: ideas are defined in context but they also define their contexts, and vice versa. Ballonoff's analysis applies to *some* culture, but certainly not *all* culture or culture in general.

The second problem concerns marriage rules specifically. When ethnologists speak of "marriage rules," they usually mean stated and enforced rules dealing with incest prohibitions, marital residence, dowry, inheritance, and the like. Ballonoff does not relate his discussion to things of this sort, and since these are *prima facie* the most relevant sort of cultural phenomena to connect it to, then it has to be said that he does not relate his discussion to "culture" as it is generally observed and described and the analysis remains in that sense empirically isolated.

Although Ezkhova and Ballonoff cite each other in mutual support and use similar mathematical ideas and styles of argument, their approaches are otherwise quite different—but perhaps from their own perspective complementary. Where Ballonoff is modeling culture as a system for information transmittal Ezkhova represents it as a system for cognition and decision-making, a kind of expert system. The base is the individual actor, or "e-machine" (Ezkhova-machine). Groups and whole cultures are treated as aggregates of individuals. The actor has cognitions and makes decisions, which Ezkhova holds to be rational and "culturally relative." The same formal structures apply to groups and cultures.

Ezkhova does not assemble the whole system but rather models what she takes to be certain crucial parts and argues that they are mutually consistent in principle, apparently because the mathematical formalizations are mutually consistent. The features chosen are quite different from earlier arguments concerned with culture and cognition that were aimed at showing cultural determinism. Ezkhova's assumption is not that cognition is culturally determined but that it arises from individual perception and cognitive choice.   She also assumes that the aim of perception is make decisions, and she assumes that these decisions are rational and adaptive—with evolutionary consequences. In these points all the panelists would agree. The difficulties arise with how her formalizations tie them together.

The formalization of the idea of a context is based on the idea of "tuning on experience" in terms of the distinctiveness and uniqueness of some identified feature of it. Thus here the features of "context" would seem to be features of a person's objectively observable setting. She also discusses the idea of "cognitive distance" between features in a more linguistic or cultural sense and suggests an algorithm for that based on the number of classificatory terms, but the idea is not developed and the two different cognitive algorithms are not linked up. Her formalization of the idea of optimization is also based on two ideas (apparently): first that an actor can chose among possible representations and second that given some representation the actor can make the decision that seems most satisfying.   These two ideas are also not linked up, but the claim clearly is that all such individual representations can be accumulated to compute "the cognitive state, $G_k(t)$, of the culture K, and moment, t." (p. 11). Thus this is a "theory" of culture that simultaneously encompasses "the culture as constructed by individuals, the culture as shared among individuals, and the observations about either created by anthropologists (p. 20)."

Of course the most important problem with this is that it does not fit the facts. Culture is neither a perceptual screen at the individual level nor an aggregate of

individual perceptions at any other level. It is not an "it" at all. There are all sorts of cultural that systems Ezkhova's algorithms do not recognize while the cognitive processes that they presuppose are not to be found, such as context as just individual selective perception.   But given that, the scheme does have the kind of use van der Leeuw indicates. Ezkhova's view of culture is neither unique nor naïve. Similar views are widely shared among contemporary cognitive anthropologists, sociologists, and many others. It is useful, therefore, to take her formalisms as a serious effort to specify its implications. In effect they pose the question "*what if* culture were like this?" What if people really did think like "e-machines?" What the analysis shows is why it is not. It could not work. First, the data demanded is effectively infinite. One would have to know all the possible most unique features of every possible context in which each individual might perceive themselves at any one point in time. Second, the programming task is impossible. With this information, one would have to simulate all possible situations, distinguished by their most distinguishing features, for every individual on a running basis in order to know when they switched from one possible situation to another, and then one would have to model how these situations interacted—recognizing that for two people to communicate they must be in the same situation rather than different situations. And finally, it is impossible to imagine how any computed value of $G_k(t)$ would be interpretable. The wonder of culture as we really find it is that it allows us to think and act in far more diverse and complex ways at far more levels over a far wider array of time frames with algorithms we hardly notice using.

This kind of from-the-individual-up-to-aggregate process is not the way people actually distinguish situations—as Lyon's and Fischer's papers very clearly recognize. We do not first go through a series of possible distinguishing features at the individual level, then decide on a situation, and then deal with others (or it) in terms of that identification. Rather, we interactively identify a situation and within it focus on (not perceive) the relationships that identification entails (not distinguishing features in a perceptual sense). We can, and very often do, identify precisely the same physically perceivable situations in entirely different situational ways.

All the other papers agree that "the" culture of a community is not one thing but many, not one system but many systems.   They differ in their views of how many such systems there are and how clearly they are differentiated. The positions generally range along a continuum from the position of Read and Leaf that there are several entirely discrete, well-formed and bounded systems that exist in clear cultural consensus and can be sharply differentiated from the organizations they are used to create, to Kronenfeld's view that the culture of a community has a unity but that it is like a quilt, a "thing of shreds and patches" which he describes as having "a shape and form but no overarching structure." In this view, things with structure make up "subsystems."   The other papers fall in between. What are subsystems for Kronenfeld become systems for everyone else and the differences concern exactly what they are and how clearly delineated they are.

I do not think these differences amount to serious divisions, for two reasons. The first and simplest is that the overall situation is very nicely conveyed by the old simile of the blind men describing the elephant. Everyone has only a piece and guesses about the rest. The difference is that in this case everyone *knows* they only have a piece and are trying to work together.   The trick is get a clear sense of what the piece is in each case and then to see how they all fit together.

The second reason is that the differences are less an artifact of what we see than how closely and comprehensively we try to describe it. Science is a search for connections, but how firm do we want the connections to be? How firm a connection do we *dare* to look for? The lower our standard the easier they will be to find, but at the same time the more diverse will be the things we jumble together and the more inconclusive will be our analyses. For most social scientists the standard is extremely low. In sociology and econometrics it is common to accept formalizations as reasonable if they would produce results with the signs in the right direction. Correlations, however weak, are constantly taken for causes and statistical significance is constantly taken as showing actual significance. In anthropology the weakness shows up in the way subject matters overlap. A description of the religion in X will commonly include many of the same activities and ideas as a description of the economy of X or of kinship in X, although if you ask the people of X if their religion is the same as their economy and their kinship, they will say it is not. Such a weak sense of a connection is precisely what enables one to argue that everything is part of a single cultural whole but it is also why one can only conclude that the whole is a thing of shreds and patches.

There is really just one workable scientific standard for what counts as a connection. A connection must be invariant in one of three ways: either an x always occurs with a y, they always preclude each other, or there should be some fixed relation that links them into a larger pattern of either type (ie: x always occurs with either y or z for reasons that can be stated—wheat will always be rotated with whatever crop can grow between the time it is harvested and the next sowing that meets complementary needs), and in all three cases you should know why. Until you apply such a standard it is easy to believe that it is too exacting to yield anything in social analysis. After you apply it, you realize that nothing else really works. If you do not seek such connections you will not find them. If you do seek them and still do not find them, then you will know that you need to look elsewhere and eventually you will find where they are.

What we have, then, are the pieces of a puzzle. The problem is to fit them together. My solution, which I think at least most of the contributors will accept, is shown in figure 1 in the form of a model of the process of creating and maintaining a society using cultural resources. Cultural resources are ideas and artifacts which people create and pass on through teaching and learning.
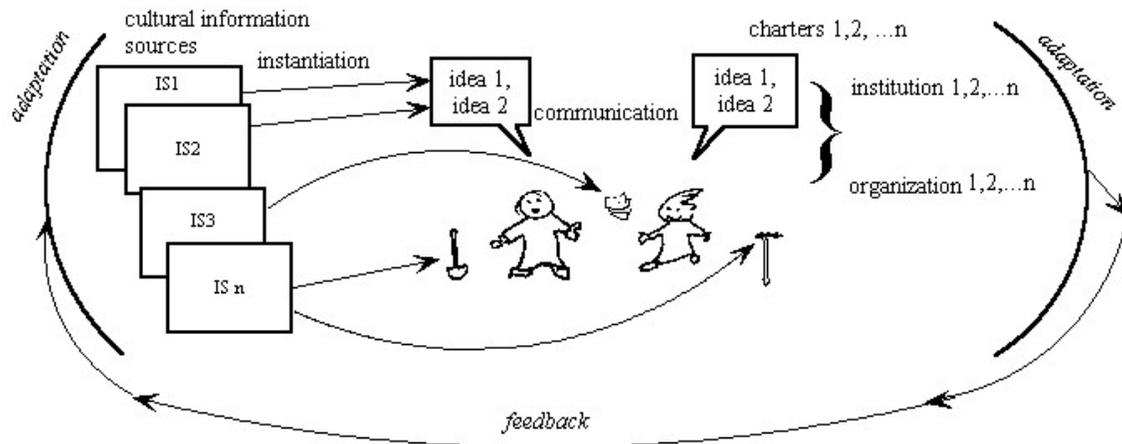
The Social Process

Reading from left to right, the overall process is a feedback loop beginning with environmental adjustment through information sources, to communications, to organization, and back to environmental adjustment. Expanding on this, the idea of environmental adjustment is the society-nature interface that Read and van der Leeuw call attention to--the cultural-ecological adaptation of the community. This adjustment is both reflected in and shapes the information sources. Such sources vary in their formal properties from very low entropy systems that establish moral relations to relatively high entropy (high information potential) sources that make up technologies and systems of theoretical and practical science. The elements of these information sources are drawn upon symbolically in communications, where they appear as ideas. Communications are used to organize activities, and this involves creating the charters under which people form organizations and mutual adjustments of behavior to accomplish actual goals. Such organizations engage in work, and work produces continuing adaptation.

The diagram is not a representation of something people are supposed to be "in," in some sense that leaves out their own conceptualizations, but rather a description of the various kinds of conceptualizations they use and what they use them for. The conceptualizations themselves vary unendingly from community to community. The general types and the processes in which they are created and employed, however, are constant.

Three points should be noted about the model's overall shape before we turn to the separate components. The first is that it does not apply to the process of ordering behavior just once at one level of scale, but many times at all levels of scale. It is recursive, as Fischer's paper argues it must be. It applies to the creation of organizations and adaptations on the most microscopic interpersonal level and at the largest international levels. It therefore also represents the way these levels are interrelated: they are homologous in organization and the smaller instances are the building blocks of the larger. Second, because of this recursiveness what is accomplished in a cycle at one level is part of what happens at other levels. Third, the idea behind having the same environmental interface at the beginning and end of the feedback cycle is only to indicate that it is the origin and destination of the feedback process, not that it exists outside or somehow at the edges of the community in which those processes occur. Rather, it exists pervasively throughout it, at all levels of scale.

If we consider the components in more detail we can more fully appreciate the extent to which the papers fit together and represent a qualitative leap in the precision and power of ethnological theory.

Cultural Information Systems

The blocks on the left side of the model designated IS_1 to IS_n are the cultural information systems, or cultural message sources. These are not simply some sort of aggregate or sum of individual opinions but formally organized systems of ideas that individuals use, learn, teach, and preserve. They include both social idea systems and technical idea systems: the cultural ideologies that define the various kinds of social relations people may have toward one another and the systems of ideas that are imbedded in the material apparatus of the society and its technologies. Kinship terminologies are an example of social idea systems; Euclidian geometry is one of the most overtly conceptual technical idea systems. Scientific theories are other examples, and bodies of practical knowledge and technique are yet other examples.

The cultural message sources are *not* bodies of field data like those Fischer describes with XML and analyzes with measures of non-randomness like χ^2. Rather, such texts are messages or collections of messages. Information theory predicts that ideas associated closely in message sources will be associated closely in actual communication. This is a way to apply that prediction. What Fischer and Janet Bagg (2002), in particular, are describing is a way to automate the process of starting with field data (actual communications), reconstructing or identifying the sets of ideas that make up the information sources that they draw upon and then using those sets to simulate (or reconstruct by simulation) actual behavior by the use of agent-based models. This is a powerful vision. It is in effect a computer simulation of ethnographic analysis that can provide a strong support for such analysis—both in pointing out relations to be explained by field investigation and by providing a way to see if behaviors derived from the field analysis match observable behaviors. It is not, however, a replacement for field analysis and is not offered as such since it can only provide the frequencies with which ideas in the message sources are associated but not the message sources as such. It can say what the clusters are, but not the basis for their organization.

A simple example of trying to find message sources by inferring their content from ongoing behavior would be trying to learn Euclidian geometry by watching people measure land or frame houses. Perhaps you could do it if you were Euclid, but for most people it is far easier and far more direct to find a knowledgeable person and ask that person to teach them geometry directly. Field elicitation of any other cultural information system is almost exactly the same; the only difference is that the learner has to take more of an active role in organizing the learning situation. I describe a highly formalized version of it for kinship terminologies. Lyon describes it in the more usual way for the ideas that define the hierarchy of adjudicative bodies in Pakistan and the factional ideas that are utilized when one is arranging to appear before them. The important thing is to conduct the elicitation in such a way as to allow one's informants to move from one idea to another without the analyst injecting alien presumptions. When this is done, the records they produce are the exact counterpart of a photograph of a track in a cloud chamber or the readout of a spectrograph. They yield the actual arrangements of ideas

being sought—terminologies, models of courts, and so on. Usually such indigenous models include some kind of graphic or diagrammatic representation. It may be extremely simple. The factional model behind Lyon's description of Pakistani court strategies is a single vertical line representing opposition. Or it may be quite complex, like the kinship chart. Such elicited models, when formulated as imagery, *are* organized. The graphic layout of the American English kinship terminology is its organization, its structure. The hierarchical imagery is the organization of the idea system defining the adjudicative bodies. The images have logical properties. There are some inferences they definitely lead to and other inferences they definitely preclude. In addition, however, the logical properties of these organizations can be further exposed, tested, and displayed by mathematical or logical analyses as Read and I describe (respectively) for kinship terminologies.

Shannon and Weaver were not ethnographers and in framing their mathematical theory of information they often spoke of communication and message sources in ways that are ethnographically unwarranted. They did not know what form naturally occurring message sources actually took. Since their idea of information was drawn from statistics, it was natural for them to draw their imagery for message sources from statistics as well. So they generally spoke of them using the model of urns containing different numbers of balls with different characteristics. The trouble with this is that ideas are not the sort of thing that one can simply pile up or pour into something, and there is nothing in nature (or culture) corresponding to such containers. Idea systems are not held together by being pressed in from the outside but by being tied together internally. The structure of atoms and their constituent particles is a better analogy than containers and balls.

Semantically and formally, cultural information systems are divided into two major types: social idea systems that define social relations or positions that people occupy and technical idea systems that define things. Although all such information systems can be elicited and recorded as systems of definitions, the definitional status is usually much more obvious in the case of social idea systems. These systems, which define such things as kinship, religion, politics, and economics, far more clearly have the character of ideologies to be imposed on reality than the character of descriptions drawn from reality.

The technical idea systems vary in form from a few that are highly conceptual and highly organized, like Euclidean geometry, to many more that are almost entirely embedded in material assemblages, like the technologies of making pots or farming. But even Euclidian geometry, despite its abstract and highly organized character, is not used normatively the way ideas of kinship are used normatively. We recognize that there is no perfect triangle in nature just as we might recognize there is no perfect son, but when we find an imperfect triangle we do not think we should lecture it on how to improve itself. We treat the ideas of the technical idea systems like the ideas of the empirical sciences, rather than as ideologies. We can change a tool in a tool kit without damaging the whole system of tools and the functionality of specific tools. We cannot change the idea of a father or a judge in that way. In terms of the mathematical theory of information, more loosely organized systems with more elements are systems with higher information potential. Each item, when it appears in a communication, can evoke a response with a very low probability of occurrence, hence a response that is highly specific. This is exactly what happens. The idea of a hoe, or even a right triangle, is behaviorally far more

specific—in terms of what one would do to demonstrate that the idea is understood—than the idea of father or manager.

Being clear about the nature of cultural information sources as formal structures provides the basis for a systematic attack on the otherwise often confusing features that Kronenfeld indicates in his description of culture as distributed cognition, namely the many forms of culture and social organization that are clearly different yet also seem to be related, that are personal yet also interpersonal, that are private but also public and productive.   They are transmitted in the form of knowledge, but they are not simply an average or general trend of what is in individual thoughts. They are conventionalized, and this is done in ways individuals can draw on individually and collectively. Highly organized and formalized cultural models like kinship terminologies, clan systems, and ideas of government can be maintained and promulgated through quite different cultural mnemonics than idea systems pertaining to how to farm or cook, and individual understandings built up with these are promulgated and maintained with very different mnemonics than ideas in their general form.

In general, the total number of information systems held by substantially everyone in a community is inversely related to the size of the community. When we think of a large-scale society in the sense of Great Britain or America we intuitively recognize that the number, n, of cultural information systems in concurrent use somewhere or another in the population is enormous. Simultaneously, however, we also recognize that the number of cultural information systems shared and used by substantially everyone is very low, perhaps just one or two (the governmental idea system and the economic idea system, for example). Both of these observations are involved in the common intuition that such large-scale societies are "specialized" or highly differentiated.   In societies we think of as "small scale," by contrast, such as an English or Indian village, the total number, n, of information systems in use somewhere or another in the society is far smaller but the proportion of these shared by everyone is substantially larger, both in absolute numbers and as a proportion. This is why these communities seem more homogenous or undifferentiated. In the Punjabi village I have described elsewhere (Leaf 1984) the number of idea systems with substantially universal consensus was six, and ethnographic village studies of similarly sized communities elsewhere around the world suggests that this is typical.

However, while the total number of information systems in play in the communities on these different levels of scale differs, the number in use for each individual generally does not. We cannot translate complex versus simple societies into complex versus simple people. For adult individuals, the number of information systems held in mind and used regularly seems to be more or less constant at something like five to eight, depending on the range of activities the person habitually engages in and, doubtless, their level of intellectual ability. These always run across the same range of formal types. There are always a few, perhaps two to four, low information systems, and most often a smaller number, perhaps one or two, high information systems.

Communication and Instantiation

In the communicative process represented in the central section of the model, symbolic media are used to evoke the ideas of the information sources in order to create

agreements interactively. Symbolic media include language, as all the contributors recognize, but are not limited to language. A courtroom bench is no less a symbolic representation of the idea of a courtroom than the word "courtroom." The real stuff of money is as much a symbol of the idea of money as is the word "money." Both invoke the same idea of money and, thereby, also the other ideas associated with it in conventional cultural terms: buying, selling, receipts, legitimate possession, the opposite of stealing, and so on. An actual hoe is as much a symbol of the idea of a hoe as the word "hoe," and conversely the idea of a hoe informs the use of the word "hoe" just as it informs us of the use an actual hoe.

While the cultural idea systems that define social relations all provide models for reciprocal relationships they do not usually provide or define an organization as such, in the sense of an actual system of mutual adjustments of behavior among actual people, or even an actual pattern for such a system. A kinship terminology is not a family or kindred; a general idea of a sale transaction does not tell you how to buy a house as opposed to a lunch. Rather, the relation between the message sources and organizations is indirect and actually involves two distinct steps as the model indicates. One stage is the process of using the basic information system to construct organizational charters. The second is going from organizational charters to actual organized behavior. These must be constructed by communicative interaction among the people who will be bound together by its outcome. In order to be a relationship *about* something, such interaction must utilize the ideas from at least one system of relational ideas and one set of technical ideas, but most interactions that establishes important and long term relationships actually involve more than this minimum.

The fact that any system of cultural ideas can be used to construct wide varieties of actual organizations explains why we find the same idea systems over wide areas and long periods of time, but at any one place and time it poses a serious practical problem. Flexibility is essential for effective adaptation, but so is predictability. A community where every organization is just the free invention of its members would be chaotic. We do not find chaos. We find replication, and we need to ask how it comes about. The answer is that while people *can* invent new combinations and permutations of the ideas of the cultural systems at will, most of the time it is not in their interest to do so. People who form organizations do not, as a rule, want that organization to be recognized only by those who make up its membership. They also want it to be recognized by those outside of it. To provide for that, they must use combinations of the main ideas they know are already accepted and established. These patterns are what anthropologists sometimes call "social charters" and they take three main forms: relational models to be acted out (ceremonies), verbal models (authoritative stereotyped descriptions, spoken or written) and symbolic models (like the statue of blind justice as a model of how courts should act). Of these, by far the most widespread is ceremonies.

Ceremonies act out specific combinations of cultural definitions, associate them with specific, actual purposes, and assign them to specific, actual individuals. Each specific combination sets up an organization: a mutual adjustment of behavior. Most long standing, important groups usually have several such organizations and the ceremonies that represent them represent them all, but in different segments. Think of the different ideas of the marital relationship enacted in the different segments of a Western wedding ceremony: the highly personal and individualistic goals of the bride and groom enacted in

the bachelor party or bridal shower, the selfless and unworldly unity enacted in the religious ceremony, the pecuniary goals for the couple as a housholding pair enacted by the wedding gifts, and the familial social and economic cooperation enacted in the wedding reception. Why would it be inappropriate to display the gifts in the Temple, Mosque, Church or Synagogue? Because the ideas represented by the gifts do not fit with the other ideas in the *particular* conception of what the marriage is that is enacted there. They fit into one social charter, but not *that* social charter. Why would it be inappropriate to have a rabbi or priest at the bachelor party? Because he represents ideas that would be inappropriate to *that* organizational charter. But which set of ideas "really" defines the relations among the people concerned? They all do.

The Mambila Nggwun ritual described by Fischer and Zeitlyn (2002) exemplifies the same process, although the argument is slightly clouded by the way in which it is aimed at counteracting currently popular efforts to construe such ceremonies as "texts" in a literary sense. In a text, sequence is important. In this case, it is not. Their informants have no idea of it. They know what actions should occur, but do not seem to pay attention as to when. Fischer and Zeitlyn are clear about what these actions are and what they express. There are three main sets and they enact three main organizational models: Chief in his compound, Chief in the village, and other compounds in relation to the Chief. *Why* is the idea of order of presentation not salient? The surface explanation is that it is not important in the relationships. The deeper explanation is that if the informants were to say that the order is important, it would be tantamount to saying there are not three separate ceremonies but one, not three organizations being represented but one, and this is precisely what they do not want to say.

Ceremonies take the ideas out of the abstract systems of definitions that are current as cultural information sources and turn them into scripts for enactment in daily behavior that are also charters for common forms of organization. Usually these organizational charters combine ideas from multiple message sources. For the Mambila, Chiefship may be a distinct idea in a system of ideas of tribal organization, but the specific organization represented by the Nggwun ceremony obviously also draws upon ideas of kinship, of economic production, of the household as a unit of production, and of the importance of maintaining an attitude of cooperation in and between households. Of course, the ceremony is a message source of a certain kind as well and is related to the primary message source in a manner very much like the relationship between an established mathematical proof and the basic ideas of mathematics the proof draws upon.

Context as described by Lyon, Fischer and Zeitlyn is an aspect of organizations. A context is a set of recognized relationships defined by one particular set of relations (one social charter) as opposed to any other set. To violate the definitions of that social charter is to do something inappropriate in that context, and to change those relations is to change the context. Contexts are treated as, or appear to participants as, the manifestations of organizations in behavior. Invoking a context (or creating a context by invoking an organization) allows participants to engage in activities in title of their organized relationships to whatever extent they need to do so. They can then "turn off" the organization (dis-invoke it) and do something else (change the context). Later they can re-invoke the organization (return to that context) while acting as though the separate appearances were all continuous with one another and there is no need to take into account other intervening activities that the individuals concerned may have participated

in. It is a wonderful device, essential to the development of any sort of social complexity, and there is no human community where we do not find it.

The problem of finding a consistent way to characterize the relationships among the ideas in the idea systems, their use in building organizations, and the relation of those organizational charters to behavior has rarely been subjected to a sustained discussion. Anthropologists generally recognize that the one-for-one imagery commonly employed by sociologists to describe the relation between "norms" and behavior is hopelessly simplistic and counterfactual, but a clear alternative has been very difficult to formulate. About twenty years ago, in a widely appreciated article titled "Closed Systems and Open Minds," E. R. Leach argued that the relationship between an element or set of relations among elements in a cultural information system and the way those elements appear in any given run of behavior is something like the relationship between two figures in mathematical topology: they may at first look different, but if we trace out the relations, element to element, we see that they are logically the same. The picture developed in these papers is both more complex and much clearer. Two of the papers each present an important aspect of the way elements are related. At first glance these two views may seem to be in conflict but in fact they are complementary. One is Read's notion of "instantiation," the other is Fischer's notion of "deontic" logic.

Fischer's argument, insofar is it turns on his observation that "in complex contexts many more 'events' could have happened than did, and often in many different orders" (Fischer 2002: 370), focuses on the relationship between organizational charters and behaviors. It also applies, however, to the *choice* of elements from the cultural information sources and to their use in constructing the charters. It does not, however, adequately deal with their logics when so used. Deontic logic was originally developed as a formalization of moral, rather than factual, assertions. It continues to be an area of dispute and analysis among philosophers. It is not something we can apply off the shelf. Yet what is interesting about it in this kind of application is that it contains notions such as "oblige" and "permit" as well as the more usual "is" or "is in the class of."

Once an idea is chosen as a message source to be applied in constructing an organizational charter, or discussed in the context of behavior, then the logic is far more definite than what is suggested by Fischer's discussion of "scientism." Fischer argues that the kind of determinate relations we expect in the physical sciences cannot be found; Read shows they can be. Even though we are free to select, juxtapose, and interpretively apply ideas from our general systems of definitions, we are not free to violate those definitions. We can apply the idea of father or of price in all sorts of ways, but if we say a father is not a progenitor or a price is not what is paid, then we have not interpreted or applied them but rather destroyed them. Ideas have logics and if those logics are not preserved in use the ideas themselves are not preserved.

Instantiation is the process of transposing a set of defined elements from the form it takes in an abstract system to a form in which it is concretely applied, as Read says. Organizational ideas are instantiated in the creation of social or organizational contexts. It is the process by which the implications of an element defined in one or another of the cultural information systems takes on the implications it has in actual communication. The idea of instantiation is that there can be a precise mapping from one organizational charter or general information source to its context (through the charters), which implies a level of exactness that Fischer's argument seems to preclude. For Read (and I would

agree), the difference lies in the constraints. Read makes the very important point that one of the main differences between the form an idea takes in its information system context and the form it takes when instantiated is that instantiation is always constrained by an idea of time. I have argued here that another such constraint is purpose, and there are doubtless a few others.

Notice, however, that the two arguments do not actually meet head on. The indeterminacy Fischer describes pertains to the actor's problem of choosing one idea or another and in relation to one purpose or another, while Read's contention that there is a regular and describable instantiative logic applies to the way the chosen ideas actually work. What we find is that the particular kind of instantiations that all the papers are describing can quite properly be described as deontic mappings. That is, the relations between ideas in their message sources and those same ideas in behavior are mappings under deontic conditions. As such, they are actually not covered by any existing branch of mathematics or mathematical logic, but rather open a new one—perhaps several.

Organizations, Groups and Institutions

Organizations are arrangements of positions or relations with some common organized purpose, such that those who occupy the positions or relations have mutual rights and obligations. Organizations are not groups. Groups are recognized sets of actual individuals. While organizations are usually formed by groups, groups rarely form just one organization. Virtually all important groups in a community are multiply organized. In the West, a household is a group. The sets of mutual relations enacted in the several separate segments of a conventional Western wedding ceremonies are its initial, stereotyped organizations. These are drawn from a variety of message sources: kinship, economics, ideas of social class, friendship and religion. Of these, the ideas drawn from kinship are represented as primary from the point of view of identifying the group to outside interests, providing the titles of the positions occupied by the members, and defining the general context the members are operating in (that is, the context of kinship). For other types of groups, different organizations and contexts will be primary: occupational, governmental, and so on. But the actual organizational bases of the interactions among the group's members are almost never this one-dimensional.

If culture were unitary—if in every community there was just one system of ideas and values attached to one social organization—the relationship between organizational ideas or rules and actual group characteristics would be straightforward and we could apply the simplistic norm-versus-compliance or structure-versus-behavior way of speaking that dominates Positivistic sociological theory. But because culture is not unitary the relationship between "social structure" and "social organization" is complex and for a long line of Positivistic ethnological theorists from Radcliffe-Brown to Bourdieu, the inability to describe it has consistently led to confused and arbitrary prescriptions for social theory as such.

We can think of groups and organizations as existing in the ethnographic *now*. When we conduct a field study they are what we observe most directly. We readily find sets of people who identify themselves as associated with one another and usually with some material apparatus, and there are organizational charters that the members of such groups can describe and hold each other to. Over time, however, the group

characteristics and the organizational forms interact and the results of this interaction are not predictable from the group characteristics and organizational ideas alone. The relationships people form on the basis of any one organization necessarily reflect their commitments in terms of their other organizations they use, and also in terms of what is being done in related organizations in other groups. There may be an expectation that boys marry girls of families of the same social class and different clan, but exactly what families this may link together will depend on how many families of each clan each social class may contain. It may make economic sense that farm families hire members of non-landed families for labor intensive farm operations, but exactly what links will be formed between landed and non-landed families will depend on how many families of each type there are, what other opportunities are available, and perhaps additional social considerations such as who supports whom politically. Since the constraints on group demographic and other characteristics never arise from just one of the group's organizations, they cannot be expected to conform to the "rules" of just one organization.

The present papers address this problem in two ways. One is to focus on a set of individuals and track them through several related organizational contexts. This is what Lyons does in relation to Pakistani kinship organization, factions, and the several different types of courts. It is also implicitly what Fischer does and indigenously it is what ceremonies such as the Nggwun and the Western wedding do. I will return to this. The other is to focus on one or more type of relations, trace out the way individuals are connected through them for an entire community, and compare this pattern with what we would expect from the corresponding organizational rules. This is what White's network analysis does, in what amounts to a three pronged attack. First, it provides a precise way to describe the linkages formed on the basis of the organizational charters, leading to what White calls the "emergent rules" as contrasted with the stated rules. White has applied this approach in describing marriage relations in certain kinds of kinship systems (cf. White 1999), trade relationships in the world economy (Smith and White 1987), the emergence of school attachment out of cohesive subgroups in high school friendship networks (Moody and White 2003) and other types of relations. Second, he has also formulated ways to express the expectations for such patterns implicit in the stated organizational rules and compare them with the emergent rules (also White 1999). Third, this automatically generates the possibility of finding relationships between the emergent rules and the stated rules over time. And finally, multiple network analyses in a single community can be treated as overlays—relating, for example, marriage networks to economic networks—which can let us see how the organizational consequences of such organizational rules interact.

White's article in this volume is an overview of the kinds of patterns that can be found and their possible interrelationships in a formal sense, including the ways in which they can coincide, conflict, and/or possibly reinforce one another. Among other things, this can provide an entry point for explaining *either* why the rules as stated and the rules as they seem to be followed may differ *or* how stated rules and *de facto* rules might interact and influence each other over time. For example, we may find that a marital network substantially overlaps or corresponds to a network of economic exchange, even though the two are conceptually distinct. This would not mean they are "really" the same, nor would it mean one is reducible to the other. But it might very well lead to questions that would show how they motivate one another or fit into larger adaptive strategies for

those concerned. Conversely, such analysis can also let us explain why we so often have quite clear "objective" groupings and patterns of relations with no corresponding organizational rules at all. This is pioneering work and there are many points where White's substantive formulations do not quite mesh with mine, Fischer's, or Read's (an organization in the sense of an accumulation of relationships over time is not the same thing as organization as an indigenous conceptual model in the present, for example). Yet it is clear that we are all talking about things that are real and interrelated and finding ways to speak of them clearly together will make all of our descriptions more penetrating and precise.

Institutions are yet another type of organizational phenomenon—different from both organizations and groups as well as from networks or emergent patterns. In conventional social theory, institutions have often been described as organizations on a very large scale: "the" family, "the" legal system, "the" economy, "the" class system and so on. They *seem* to be organizational totalities that encompass many separate and smaller aspects of specific types of organizations. "The American family" seems to encompass American household groups, extended kindreds, lineages, generations, marriage rules, inheritance rules and so on. "British law" seems to encompass law offices, courts, the police, the training systems and aspects of Parliament.

The problem with this representation is that it is quite literally an illusion, socially constructed by very definite and describable indigenous processes. When we try to elicit the properties of institutions in the way we elicit the properties of actual organizations, we cannot obtain them. Instead, we are met with confusion upon confusion. Defined roles and relations simply do not connect up; purposes disappear in muddles.

There are two main reasons for this. First, institutions do not have specifiable memberships as do organizations. Second, they do not imply a set of mutually consistent performance expectations. The ideas of the different information systems that these omnibus projections lump together are not the same. Usually, they are not even mutually compatible. The relation between two people as husband-wife to each other is not necessarily logically consistent with the relationship between father and mother from the point of view of a child; the idea of a relation between two men in a South Asian household in a managerial sense is not the same as the relation between brothers in a kinship sense. A lawyer's obligation to the court in his capacity as an officer of the court is not the same as, and may not be consistent with, his relation to his client as the client's "zealous friend." In an actual group such conflicts are avoided by mutual agreements about context separation—who does what in which context. For an "institution" in the abstract, there are no such understandings because there is no one to arrive at them. Organizations link actual expectations among actual people. Institutions are organizing presumptions that appear to lie behind them in the way a row of lights suggests a row behind or beneath the lights, but actually "appear" is all there is to it.

The segments of the Western wedding, Lyon's analysis of Pakistan legal disputes and Fischer and Zeitlyn's analysis of the Nggwun ceremony all show how the illusion is created. The key lies in the way the various sub-activities in the descriptions, although clearly related, are also separated. Between the segments of the ceremony are clearly identified bits of non-ceremony. As has already been indicated, the segments are separated by time and place as well as by symbolic formalities because the ideas they contain cannot be combined. They do not logically fit together, and to take ideas from

one context and put them into the other creates contradictions and confusions. It follows that when we ask individuals to describe "the" family we are doing the equivalent of asking them do exactly what the ceremonies avoid: combine ideas that cannot be combined by definition. The result is the same confusion in their accounts that would have been created in the ceremonies had the ceremonies not been segmented.

Finally, ceremonies do not project such an institutional sense merely locally and simply but globally and multi-dimensionally. To say something is a ceremony is to say it is an act which is repeated again and again. It is an act of an established kind. It follows that for each organization projected by each ceremonial segment there must be not just "this" organization now being established but also many others like it. Second, just as all the segments taken together project a sense that there is some aggregate that consists of all such organizational contexts taken together—the "institution" of marriage or the household—the recognition that each such total ceremony is also repeated means that this total arrangement, too, is repeated endlessly. So that each ceremony presents a sense of each segment, a sense that it is an organization of endlessly repeated type, a sense of the institution as some aggregate of these types, and a sense that the institution too is repeated endlessly. But again, although they project this *sense* they also project its unthinkability. We have the sense and no more. Just as we could not have a coherent ceremony to participate in if we merged the segments, we cannot form in our minds a consistent model to apply to them or to report about them if we try to merge the organizational models they represent. We can name them, but we cannot describe them any more than we can describe the sound of one hand clapping or explain how 6 times 7 is 49.

Adaptation

People organize "in order to." This usually involves either producing something or deciding what to do about producing something. While it is very easy to speak of an entire society as though it is a singularity adapting to a single environment in a holistic way, in fact societies do not act this way because people do not think this way. Adaptation depends on efficiency, and there is no known algorithm by which one can bring about efficiency at the societal level without first establishing efficiency in the constituent units. [[This is essentially the argument about whether or not there can be group selection. Biologists are now arguing for group selection as a possibility, but actually working it out is not clear cut. I think there is a way to get to group selection, but that's another story.]] On the contrary, all formal models for calculating optimal solutions to allocative problems build efficiency at the aggregate level by first finding the most efficient possibilities at the constituent level and then aggregating them in a way that rejects the less efficient combinations. Essentially, this is also what societies do through the mechanism of rational choice and efficiency-seeking at the level of the individual producer, through interaction of producers via economic markets, and through collective dispute settlement in the organizations so as to provide for adjudication and social control.

Efficiency at the level of the individual productive organizations is provided for through the complementary mechanisms of rational choice, intergroup competition, and imitation. All of these, in different ways, are rooted in the same fundamental facts of

multiple cultural information systems and their use in the creation of multiple organizations. Competition is established through the use of common idea systems to create a multiplicity of groups of the same sort. Since the most direct competitors of a group are almost always other groups of the same kind, and because they need the same resources, this similarity is what defines each organization's most direct competitors, and it is from these same competitors they are most likely to learn new forms of organization.

Rationality comes about in two steps. First, the individual social and technical idea systems provide for many kinds of means-ends relations along with various decision algorithms for how to employ them. To learn how to make pots is to learn how to do the task with the least effort and waste. To learn how to buy and sell is to learn how to compare costs and benefits of different possible transactions. To learn what a father is cannot be separated from learning what a father should do, and so on. Second, although we learn all of these separate algorithms, we do not, and cannot, learn any general algorithm by which they can all be integrated, or even compared—because there is none and there cannot be any. There is no single scale on which one can array being a good father as measured by providing for the education of a daughter and being a good wheat farmer as measured by buying more fertilizer or a good manager as measured by being sure everyone does the work they do best. The established information systems say what the means-ends relations are, but because of their multiplicity each individual must decide which of these pieces of knowledge are salient for him or her. The multiplicity of cultural idea systems and the fact that no one such system dominates the others leaves no option for each individual except to find his or her own way and to combine them in order to make the best use of their fungible resources. The result is a system that virtually all of its participants are compelled to recognize as effectively optimal, in the sense that it is much more likely that working with the accepted ideas and technologies, rather than ignoring them, will lead to success.

Although analysts who concentrate on the properties of one or another analytic model of optimization may at first think it strange that the most rational strategy a producer can follow is also the most completely individualized, this is in fact the way we all operate. It is also, apparently, why agent-based models have proven to be so useful in modeling environmental adaptations such as van der Leeuw describes. It is doubtless possible to program agents as though they were stupid or self-destructive, but this is not what has been done. Rather, the agents are set up to solve practical problems in rational ways, such as to decide where to locate dwelling sites in order to maximize access to a list of resources they are known to have exploited. Such simulations have been remarkably accurate in postdicting the patterns of artifacts actually observed.

Of course such models do not show that any given adaptation is more efficient for any given community than any other possibility whatever. This is both not possible to demonstrate and is probably a meaningless idea. For any given community, the path of cultural evolution is always only one set of choices out of many. But for the members of each community, their set of historically chosen configurations arrived at under their circumstances work better than any other that they have tested. *In that context* any given individual is far more likely to find it efficient to follow the established patterns than to strike out on his or her own. Why do fisherman in the West tie their lines to their fishhooks with eyes while fisherman in Japan tie their lines around a flattened widening at the top of the shank? It is obviously not because a line tied through an eye makes a

better connection in the West while tying it around the shank makes a better connection in Japan. One is as good as the other. It is rather that in the West all the hooks you buy have eyes and in Japan they all have flattened widenings and it is far more efficient to use hooks one buys in the market than to try to make a different type on one's own. Why do Americans drive on the right and the English on the left? Because in America the laws require you to drive on the right and the cars have their steering wheels on the left and in England the laws and cars are reversed. It would be inefficient in the extreme, as well as illegal, for an individual in America to try to drive on the left or for one in Britain to drive on the right. *Why* are they reversed? Not because one is demonstrably more efficient, but rather because it would have been very inefficient not to opt for one or the other. Of course, if experience shows that such choices are not arbitrary but have adaptive consequences, like the choice of whether to put the superstructure of an aircraft carrier on its port or starboard side, then the more adaptive choice spreads and the other drops out and we are back to the situation of no difference in efficiency among the differences that now actually exist.
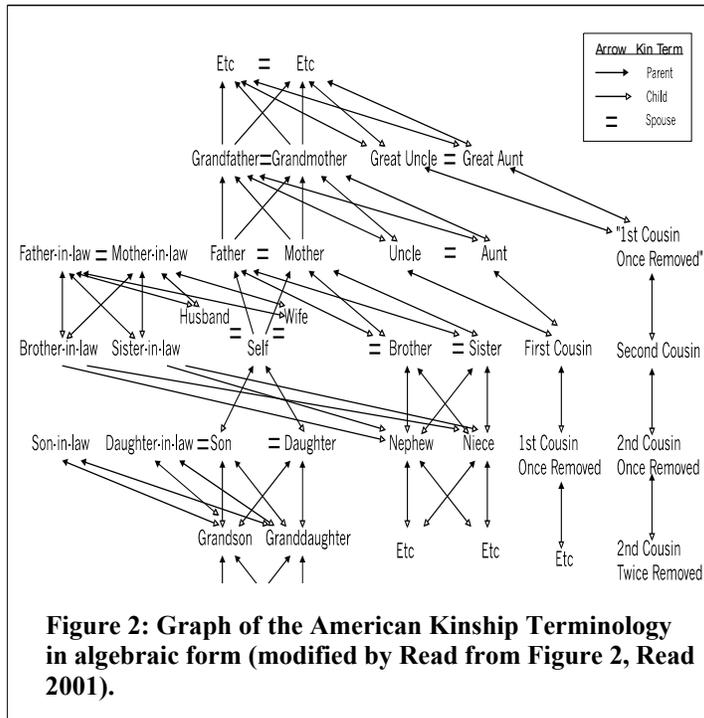
Society is, indeed, self-sustaining, though it is not self-sustaining by itself and apart from human fear, choice, thought, and foresight but rather through them. Culture is not the antithesis of rational foresight and choice but its embodiment. The consequence is the universal sense of the "force of tradition," represented in the diagram by the feedback arrow from the adaptive outcome back to the cultural idea systems, and which again exists at every level of organizational scale.

Conclusion

Human beings live in worlds of implication. Whether we are speaking about the ideas of cultural information systems, language, conversations, organizations, or adaptive arrangements, we are dealing with things that are organized and that have consequences. As social participants, we never see anything only for what it is, but always also for what it portends, suggests, or implies. To understand a culture or society, we do not want to know only what is odd or "interesting" about it. We want to know its generative bases, and the reason we want to know this is because ultimately we want to understand the generative bases of all societies. As noted by Read (1990: 55) over a decade ago, we need "models of how complex, information processing, self-reflective, self-restructuring systems operate, develop and change."

Formalization in the sense that it has been pursued here is aimed directly at the problem of exposing the generative bases of society. To see a cultural information source as a conceptual or mathematical structure, an organization as a set of mutual expectations that can be manipulated toward a common purpose, or an adaptation as something that can be simulated with a multi-agent agent-based program is to see them as generative systems. It is also to see them predictively. It is necessary to set up simulations since simulation results can then be compared with actual data. This is an enormous advance, and very different from the way formalization has been used previously (Read 1990).

Probably the most damaging misunderstanding of the experimental method is that it is a method by which a person makes *an* experiment—one, alone. One experiment alone is a demonstration, and this idea was not new in Galileo's time and is not what made him the revolutionary that he was. One experiment alone cannot bar speculation or the imposition of arbitrary assumptions, and where arbitrary assumptions enter, arbitrary conclusions follow. What Galileo showed was that the only way to respond to nature alone and not to our own preconceptions was to have not one experiment but a series of them that yield whole systems of interconnected observations. This is why American pragmatists characterized the experimental method as the method of "testing by consequences," and this is what we see here.

Figure 2: Graph of the American Kinship Terminology in algebraic form (modified by Read from Figure 2, Read 2001).

One of the most powerful aspects of the experimental method is the way it allows us to build up a picture of a phenomenon by viewing it from multiple aspects. This is very different from viewing things in terms of alternative different metaphors—organism, machine, quilt, text, physical systems, hegemony or what-have-have you. In the former case, you cannot help but add to your understanding. In the latter case what you mainly do is multiply the opportunities to talk about other matters.

I elicited and represented kin terminologies graphically. Read took this as a starting point and represented the graphs algebraically (see figure 2). In so doing he felt it was somehow truer to reduce the number of primitives. Where I had mother and father, he put parent as the generating term (upward arrows in figure 2) and added gender as an additional attribute to obtain the terms mother and father as sex marked forms of the generating term, parent. We have discussed this over several years. It has only recently become clear—first to Read and then to me—why we made these different choices. Read had first of all been more concerned with the formalizations of the componential analysts, which had misconstrued the meaning of the kin terms by rewriting them genealogically. Secondly, he had in mind a clear idea of instantiation. As a mathematician, he assumed that if the kinship ideas and the genealogical ideas really were distinct, then they should be instantiated distinctly yet have overlap through being able to refer to the same person either by using kinship ideas or by using genealogical ideas. His question was whether this would work in formal terms. His formulization was designed to test this and it has answered the question in the affirmative. Lacking his mathematical framework, I had no such concern. Since it was obvious to me on ethnographic grounds that the componential

ideas of what was constant about the meaning of kin terms were wrong in fact, I viewed genealogy as a distraction and went on about my business. The consequence now is that we both have a sense that beneath our initial primitives consisting of the core positions and the concepts that link them there are deeper and more constant primitives concerning the logic of such systems of reciprocal relationships that we are only now beginning to get a clear grip on.

Anthropology as an academic discipline is now 132 years old. Yet in these pages we see the emergence of something very new.

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