

Reciprocity and Its Limits: Considerations for the Study of the Pre-Hispanic Pueblo World

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Considerations for a Study of the Pre-Hispanic Pueblo World

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Reciprocity is an ancient and important social practice that evolved in very small-scale societies. In this paper we present an abstract model of the way systems work that are organized through balanced reciprocity (Sahlins 1972:185-275). This model will help us understand the general nature of the problems that must be overcome by societies organized through reciprocity as they grow in size. We then suggest that, in the late pre-Hispanic period, the eastern and western Pueblo worlds took different paths to overcoming these difficulties. Finally, at the invitation of the editor, we discuss the other papers in this volume that deal with the pre-Hispanic Pueblo world in light of this model.

The first part of the paper draws on theory from complex adaptive systems research, specifically the random Boolean network (RBN) model (Kauffman 1993 and elsewhere). Complex adaptive systems (CAS) research is the study of how many interacting and often adaptive agents, each of which may have access to only local information and each of which may be responding to quite simple rules, as an ensemble produce higher-order patterns and structures. Wills et al. (1994) provide an overview of several major strands of CAS theory from a southwestern archaeological perspective (see also Kohler 1993). Much recent anthropology attempts to generate thicker and more detailed descriptions of particular local societies to achieve a deeper understanding of their nature and operation. CAS approaches, on the other hand, are unabashedly abstract;

they attempt to view adaptive systems of all kinds from a distance to perceive their similarities and differences. Typically, they locate causality in the manner in which entities simultaneously interact. Although such models strive for generality rather than for the realism or precision that are more traditionally honored in our field, we believe they can be used productively nonetheless.

Reciprocity is Ancient and Fundamental

Some notion of reciprocity as a basic and structuring process is common in many theories of society and psyche. Lawrence Becker, a philosopher of the virtue-theoretic school, considers reciprocity to be a fundamental moral virtue because "its requirements have presumptive priority over many competing considerations... [it] fixes the outline of our nonvoluntary social life" (1986:5). Studies in experimental economics (Hoffman et al. 1998) regularly find more reciprocal cooperation among humans than would be predicted by rational utility considerations. A number of explanations have been offered as to how practices that may have some immediate cost to the individual could become so widespread. A series of famous simulations by Axelrod (reviewed in Axelrod 1997:1-29) demonstrates that—given a sufficiently high initial density of cooperators—cooperation can spread and sustain itself within an interacting population playing the iterated Prisoner's Dilemma. It is also possible to explain the prevalence of reciprocity in societies even where direct interaction among reciprocators is rare through indirect reciprocity based on reputation (Nowak and Sigmund 1998). A third kind of explanation appeals to our intuition that groups with many cooperators ought to be more successful than groups lacking a high level of cooperation. Soltis et al. (1995) show that if the advantage that cooperative behaviors provide to the group outweighs their costs to individuals within the group, then norms specifying reciprocity can spread,

under certain circumstances including strong between-group variation, and significant group extinction rates.

Evolutionary psychologists (Cosmides and Tooby 1992) claim that reciprocity is so ancient and so central to hominid affairs that we have evolved specialized mental faculties that allow us to readily identify cheaters (i.e., defectors from reciprocity-based systems). More generally, the increased encephalization of *Homo sapiens sapiens* relative to earlier forms may be strongly related to selection for the ability to negotiate the burdens of achieving appropriately cooperative behavior in large groups (Dunbar 1998). The antiquity of food sharing in particular is suggested by the fact that extensive transfers, helping to buffer daily variance in amounts and types of food acquired, are very common among living foragers (Hill and Hurtado 1989). They remain visible in today's traditional village societies where risk sharing protects against crop, livestock, or fishing fluctuations (Coate and Ravallion 1993). Fiske (1991) has proposed that there are only four fundamental and universal "grammars" for social relationships: communal sharing (as in generalized reciprocity towards close kin); authority ranking (as in the relationship of chiefs with subordinates); equality matching (emphasizing balanced economic and social reciprocity); and market pricing (in which relationships are mediated by values determined by a market system).

However reciprocity achieved its centrality in human affairs, the key point is that these non-centric reciprocal exchanges of goods (as defined by Pryor 1977) play a critical role as a dominant economic exchange mechanism in small-scale societies both now and in prehistory. These exchanges are roughly what Sahlins (1972) termed balanced reciprocity, though Pryor's work has shown that such exchanges may be balanced more in ideal than in practice. Cultural evolutionary models of the 1950s and 1960s associated "egalitarian

economies" characterized by reciprocity with egalitarian societies, and predicted replacement of reciprocity by redistribution as the "paramount form" in rank societies (Fried 1967:116-117). Cross-cultural analyses by Pryor (1977:203-216) support the belief that reciprocal exchange of goods (much of which is food) is most characteristic of societies with low scores on his "economic development" scale. In Figure 1 we have tabulated data on the relative importance of reciprocal exchange in 54 non-hierarchical societies drawn from the Standard Cross-Cultural Sample (Murdock and White 1969). As is commonly believed, there is indeed a strong tendency for the importance of reciprocal exchanges to decline with increasing community size.¹ We now turn to an abstract model of the way such systems work in the hopes that it will help us understand why we see this pattern. Readers who are more interested in seeing how we apply this model than in how it works can skip the next section entirely and come back to it later if they wish. Other readers, interested in still more detail than we provide, should consult Wuensche (1998) and Kauffman (1993).

Boolean Networks as Models for Balanced Reciprocal Systems

Dynamics in general is the study of how things change through time, and discrete dynamics provides a body of approaches to systems that can be conceptualized as changing at discrete points in time (Sandefur 1990). Boolean networks (Kauffman 1993:181-191) are a class of discrete dynamical systems; cellular automata, which are more familiar to many, are a special subclass of these networks (Wuensche 1994:465). When Boolean networks have no exogenous inputs, as is the case for the networks we will discuss, they are called autonomous networks. The number of elements in a network is indexed by N , and the number of connections that each element has with other elements is indexed by K . Each element in the networks we shall be discussing is either active (has a value of 1) or inactive (has a value of 0) in any time step;

elements have only these two possible states. The activity of each element depends on the activity or inactivity of the elements to which it is connected, plus the rules that govern those connections.

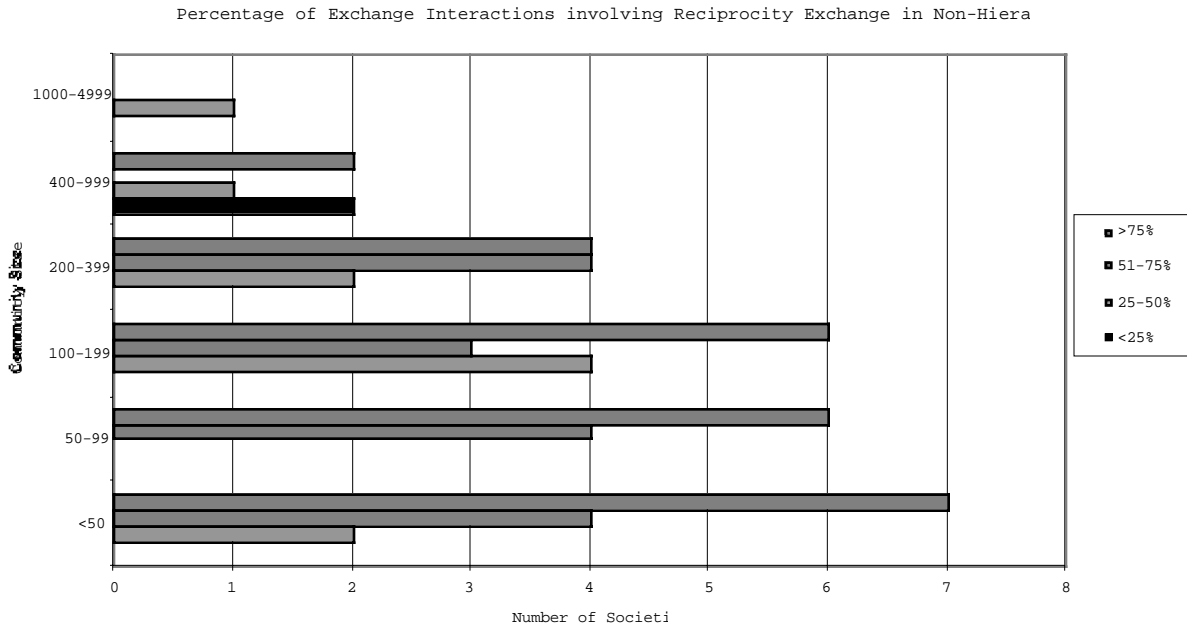


Figure 1. Percent of exchange activity involving reciprocity in sample of 54 non-hierarchical societies drawn from the Standard Cross-Cultural Sample.

Here is an example to build your intuition of what we will be talking about. Figure 2a shows a tiny Boolean network where $N=3$ and $K=2$ (so there are three elements, each of which is connected to the other two). The activity of element 1 is governed by the "and" function; it becomes active at time $t+1$ only if both elements 2 and 3 are active at time t . The other two elements are governed by the "or" function, and become active at time $t+1$ if either of their inputs is active at the previous step. Figure 2b shows each of the 2^3 possible states of this network at time t , and its successor state at time $t+1$ (read along the rows). Figure 2c shows how the 8 possible states for this

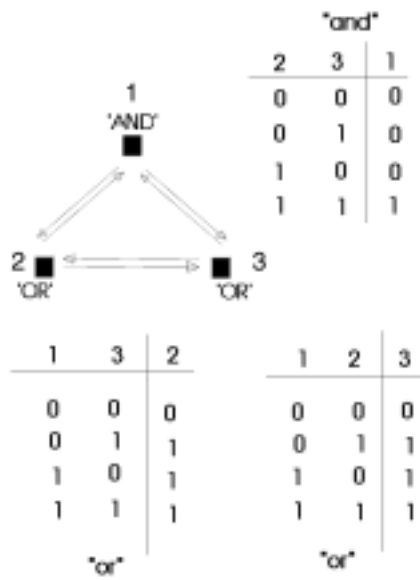


Fig. 2a

	T		T+1		
	2	3	1	2	3
1	0	0	0	0	0
0	0	1	0	1	0
0	1	0	0	0	1
0	1	1	1	1	1
1	0	0	0	1	1
1	0	1	0	1	1
1	1	0	0	1	1
1	1	1	1	1	1

Fig. 2



Fig. 2

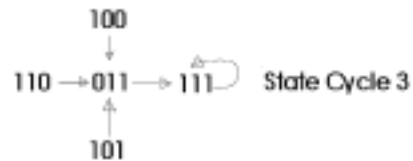


Figure 2. a: A Boolean network with three elements ($N=3$) in which each element is connected to the other 2 ($K=2$); connections are governed by the Boolean "or" and "and" functions. b: The 8 Boolean rules governing all possible states of each element in a transition from time t to time $t+1$. c: The three state cycles that represent the possible behaviors of the Boolean network represented in Figures 2a and b. (All after Kauffman 1993: Figure 5.6).

network are divided into 3 basins of attraction. The number of possible states in each basin of attraction (the state cycle length) varies from 1 to 5. Each attractor cycle (the repetitive stable behavior into which a network caught in any of these basins eventually settles) represents a permanent alternative behavior for the entire system. Without change in the wiring, or change in the rules, or some exogenous input, there is no way to jump from one basin to another. Notice that if each element begins with a value of 0, then the value for all elements will remain 0 forever (state cycle 1). If element 3 begins with a value of 1, while the other two elements have a value of 0, then in the next iteration of the network, element 2 will take on a value of 1, while the other two elements take on values of 0. By the third state transition, the network will return to its initial condition, and so forth, forever. This is state cycle 2. Any other initial condition for a network with these rules and connections will eventually result in all elements taking on the value of 1 (state cycle 3).

Boolean nets were designed by Stuart Kauffman and others, beginning in the late 1960s, to provide a computerizable approximation to genetic control circuitry, as an approach to answering questions like "what happens, in general, when the number of genes controlling other genes' activities increases?" In that analogy, genes are the N nodes in the network, and K is the number of epistatic interactions among the genes. If the rules governing these interactions are unknown for the empirical case, as they often will be, they can simply be modeled as random rules, in which case the system is a random Boolean network.

In this paper we will use autonomous RBNs as abstract models for exchange systems, to examine what might happen in human communities governed by reciprocity as the number of elements (the exchanging units, here considered to be households) in the system increases, and as the number of connections

among those elements increases. Let a state of 1 for a particular household correspond to a gift of maize (or hospitality, or labor, or whatever) to the households with which it is connected, and a state of 0 correspond to no gifting activity. In the example illustrated in Figure 2, the chosen wiring and rules result in three possibilities. State cycle 1 corresponds to no exchange; state cycle 2 to reciprocal exchange between "households" 3 and 2 in alternate periods; and state cycle 3 to continuous gifting by all households to each of the other two.

We wish to examine the notion that the systems of balanced reciprocity which, it is usual to believe, governed small-scale Neolithic communities, become increasingly unwieldy in increasingly large communities, especially if K is allowed to scale along with N . If so, then it becomes useful to think about ways in which the size of K and N can be limited. We will show examples of networks with fixed wiring and a majority rule dictating that a household will be active (e.g., gifting in the present cycle) if and only if the majority of the households to which it is linked gifted in the previous time step.²

Let's first of all examine the case where K is quite small ($K=2$). Figure 3 shows the basins of attraction for example $K=2$ networks as we scale N from 4 to 8. These attractor fields are now shown in a more abstract way without labeling the values of the elements. Now lines instead of arrows represent transitions between possible states for the network, with the direction of time for the transitions being from the periphery towards the center, and then clockwise around the attractor. This particular mapping of the basins of attraction represents only one of many possible wirings for systems of this size. The example corresponds to what might happen as small hamlets join together. In this illustration, chosen to be fairly typical, we see that the number of basins of attraction generally increases as N increases, and that

as N increases there is a tendency for the attractors to become quite "bushy" (though they remain symmetrical in appearance) and drain much larger basins (they spend a longer time going through transient states before settling into their stable behavior). Obviously there are many more possible states for the network when $N=8$ than when $N=4$.

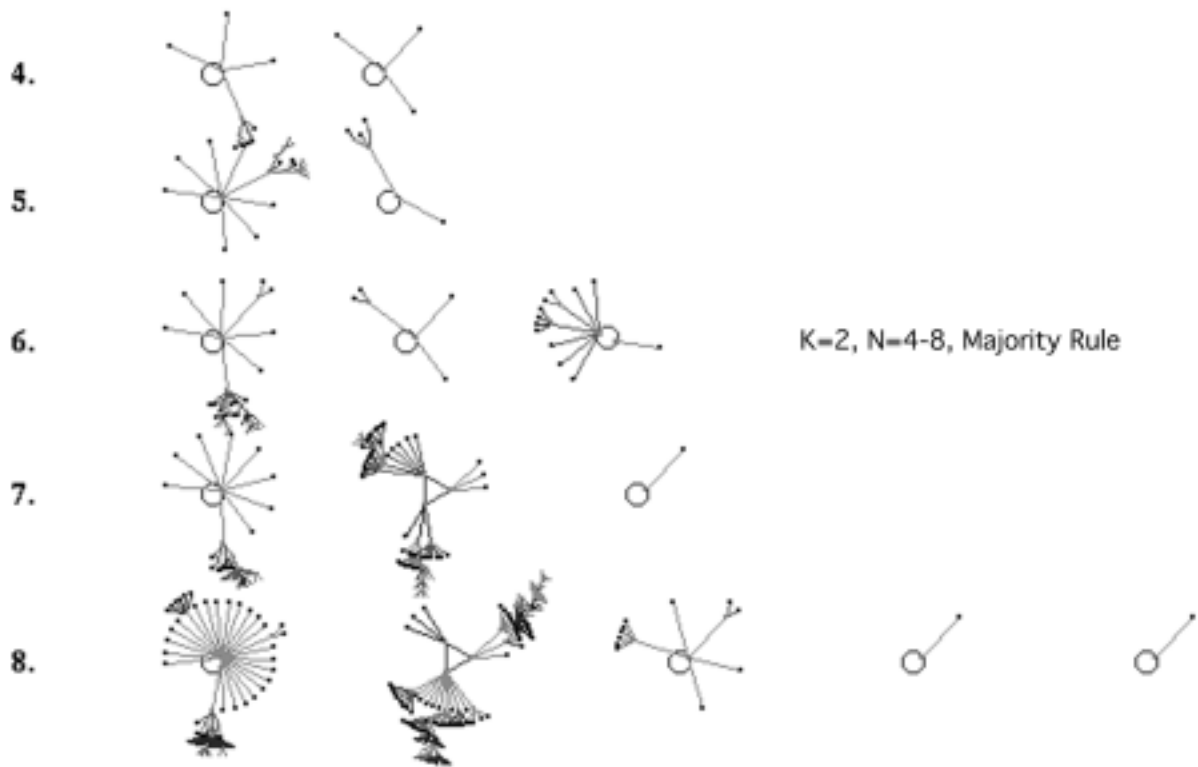


Figure 3. The basin of attraction fields for Boolean networks when $K=2$ under the majority rule, as N is scaled from 4 to 8. This and the next two figures are produced using DDLab (Wuensche 1998).

What happens to networks of $N=8$ when we increase the connectivity so that each household is connected with the other 7? Figure 4 shows the result, still applying the majority rule dictating that a household will gift in the current cycle if the majority of households with which it is linked gifted in

the previous cycle. We see that there are more possible permanent behaviors and that two of these attractor cycles have a few long, straggly, sparsely branching subtrees. These represent long periods of transient behavior until a stable repetitive result is reached. By analogy with chaos theory developed for continuous dynamical systems, this behavior is called chaotic. In such networks many possible system states lie many transitions away from a stable repetitive pattern.

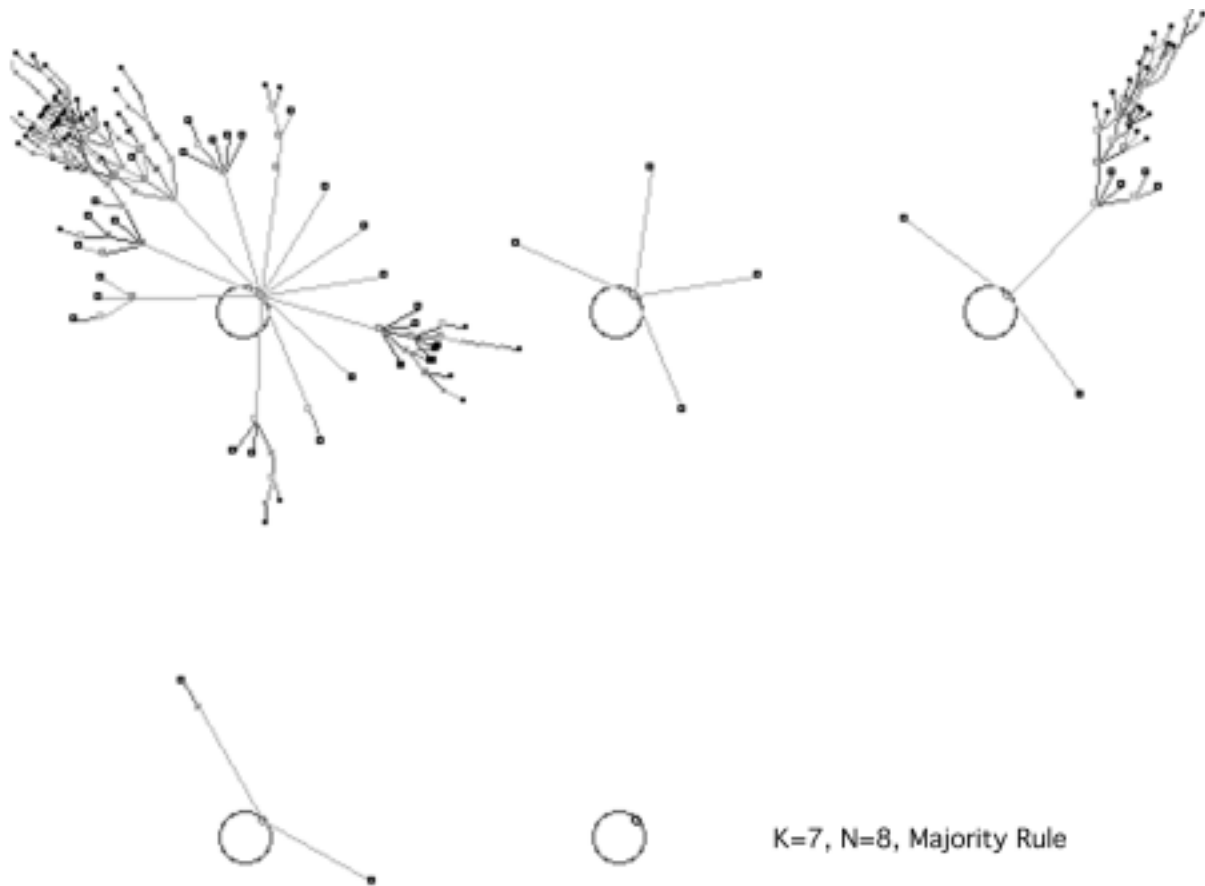


Figure 4. The basin of attraction fields for a Boolean network with $K=7$, $N=8$, under the majority rule.

Increasing K slightly to 9 and N to 32—a small village!—we see that although the numbers of basins of attractions remains modest there is a huge

number of possible states for the network (Figure 5). It is a surprising and intriguing result of the particular rule by which the elements are linked, the majority rule, that networks with this many linkages ($K=9$) do not appear more chaotic. Our brief explorations of the behavior of this rule show that compared with random rules for networks of the same N and K , it much more typically results in symmetrical, bushy state cycles in which a large number of different initial conditions rapidly settle into the same permanent stable behavior. Nevertheless, the state space (the ensemble of the possible states for the system, and their organization into basins of attractions) is quite complicated compared to, say, the $N=4$ $K=2$ space.

In our analogy, the attractors represent alternative stable patterns of exchange or interaction which systems of various sizes and degrees of interconnectivity settle into, and from which they cannot escape without some perturbation. When used to model gene networks, Kauffman has suggested that alternative attractors may represent alternative cell types in an organism. In the case of immune networks, alternative attractors might correspond to different immune states. For cardiac systems, alternative attractors might correspond to normal and abnormal rhythms (see Kauffman 1993:191).

We can't be sure that the majority rule provides the best or only possible rule for the way some specific economy based on balanced reciprocity actually worked. Fortunately, many general characteristics are known for Boolean networks with random rules and various settings for N and K (Kauffman 1993:181-224). When $K=N$ (the case of the completely connected network) the number of state cycle attractors increases linearly as a function of N , and the state cycle lengths become very long. In fact, their length is an exponential function of N . For just four households, for example, median state cycle length is 8 ($.5 \times 2^4$) whereas for 24 households it is 2048 ($.5 \times$

2^{12}). There are relatively few basins of attraction in such systems, but they take a long time to traverse.

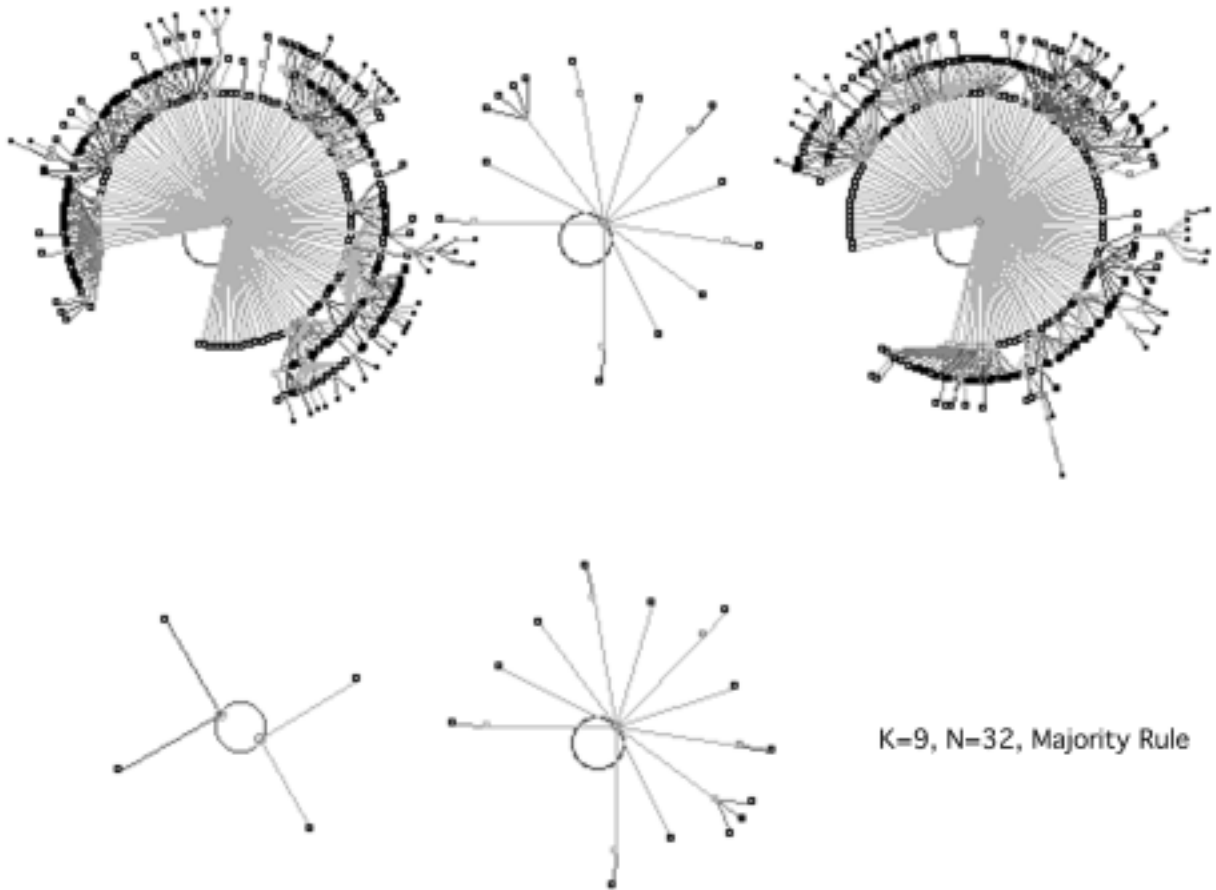


Figure 5. The basin of attraction fields for a Boolean network with $K=9$, $N=32$, under the majority rule.

Significant changes in the properties of RBNs take place as K is reduced to 2. First, the number of attractors in these more sparsely connected networks increases much more slowly (as \sqrt{N}) as N increases than is the case in $N=K$ networks. In these sparser networks the median state cycle length in

each of the attractors also increases as a function of the \sqrt{N} rather than as an exponential function of N . For 4 households, the median state cycle length is 2, and for 24, about 10. Another important contrast between $K=N$ and $K=2$ networks is their differing sensitivity to perturbation. Transient reversing of the activity of one element in a $K=2$ network usually does not cause the system to flow to a different attractor, whereas in $K=N$ networks this almost always happens. That is why the basin of attraction portraits for the networks with higher K appear more leggy and asymmetrical than do the bushy symmetrical subtrees of $K=2$ networks.

Now, in this analysis we don't know which basins of attraction represent patterns of behavior that are advantageous to the systems, and which represent disadvantageous patterns of behaviors. In the real world, of course, this is a primary consideration. We can ask a related question of our networks, however. Let's arbitrarily decide that one particular pattern of attractor represents the most fit pattern for a network. If we allow networks to change radically in their rules or their wiring of connections at each step, and measure how long it takes populations of networks to improve the match of their attractors with this predetermined target, we find that when $K=2$, as N increases, it takes increasingly more generations to improve the fit of the networks' attractors with the arbitrarily defined target (Kauffman 1993:212). More simply, adaptation is more difficult and less likely as N gets larger even when K is small. We might roughly translate this to say that in our imagined community of reciprocators, even if mechanisms like strategic choice allowed people to change their sharing behaviors fairly radically in an attempt to achieve a desired outcome, any improvement will be increasingly difficult as the number of households in the community increases. This is true even if the number of other households with whom one is connected in a potential exchange relationship does not change. As K gets larger (that is,

as the number of exchange connections among households increases), this difficulty of adaptation towards a specific target appears to get more severe.

We have not really done justice here to the richness and subtlety of RBN models and closely related NK landscape models as developed by Kauffman and others. To state things too simply, networks with high N and very small K (0 or 1) exhibit one kind of "complexity catastrophe" in that "fitness differentials between one-mutant neighbors dwindle below critical values and selection cannot overcome mutation" (Kauffman 1993:212). Such networks become frozen and the states of their elements cease changing. However, a second kind of "complexity catastrophe" sets in when the components of a system are so richly coupled together (that is, have a high K) that the network exhibits chaotic behavior. Kauffman suggests that intermediate but rather low values of K (on the order of about 2-3) "poise" such networks near the transition between order and chaos, where selection has the greatest leverage in moving them towards higher fitness through the accumulation of useful variation.

Exploring Random Boolean Networks as a Metaphor

This model has some general implications for small-scale human organizations, if we are willing to take a generous perspective and not insist too much on the exactness of the metaphor (whose limitations we will soon consider). In general, increasing either the number of the interacting households, or the density of their linkages, may put stress on systems governed by balanced reciprocity. The nature of those stresses may include increased difficulty in predicting whether the system is headed towards a favorable pattern of interaction (what basin are we in?); the length of time it takes to arrive at a stable repetitive pattern (how long will this transient take?); an increased difficulty in changing system behavior towards a desired goal (how do we get to that specific attractor?); and increased

difficulty in staying within a desirable attractor as households enter or leave the network, or rules of interaction change even slightly (how did we end up like this?)

This model suggests that reciprocity is most likely to be successful as the primary principle of economic organization in systems where N is small and K is in the region of 2-3.³ In a system undergoing increases in N , one obvious way of preventing the dynamics from becoming chaotic is to increase the size of the basal units which constitute the N , for example, by moving the level at which exchange takes place from the household to the clan, sodality, moiety, or community. This may explain why something like reciprocity can structure large-scale exchange cycles such as the Te of the Mae Enga (e.g., Meggitt 1972) where prestations usually take place among units defined at the level of the phratry, clan, subclan, or patrilineage rather than at the level of the individual. Closer to home for this volume, a solution something like this is suggested by Richard Ford (1972) for the Eastern pueblos in historic times, where reciprocity as a principle remains important, but has become impersonal and diffuse rather than personal, often structured as sodality-related transfers of food and hospitality during critical rites of passage or calendric observances.

It is also possible to construct RBNs with relatively high N and K and make them behave non-chaotically, as though these parameters were smaller. There are two main ways in which this can be done. The first is by biasing the internal homogeneity of the Boolean functions controlling the activities of the elements. If the Boolean functions governing whether an element will be on or off in the next period are unbiased, then a 1 or a 0 in the next period for each element is equally probable. But if most possible responses of an element to its input result in a 1 (or a 0), then those functions are said to be biased (Kauffman 1993: 203-208). The majority rule we used above

is slightly biased towards 0, which may be why we saw relatively orderly behavior even in moderately large networks.

Cultural norms (or at least social practice) are our closest analogy to the Boolean functions. Patterning of norms may make one type of output (behavior) much more common, given many different possible inputs. Very approximately, the corporate strategy of dual processual theory (Blanton et al. 1996) for achieving and maintaining power depends on the existence of norms patterned in such a way as to maintain group-oriented social formations given almost any input.

The other way in which more orderly dynamics can be achieved in networks with high N and K is through what are called "canalyzing functions" (Kauffman 1993: 203-206). These are functions that force a specific result, as when an element is connected to several others with the "or" function and will be forced on if any one of the elements to which it is linked is on in the previous time step. The effect of such functions in causing orderly behavior is similar to the effect of biasing functions, although the analogy here may be with societies in which power is hierarchically distributed, such that one element by itself has the power to affect the values of other elements.

We find some intriguing correspondences between the conclusions derived from using RBNs as models for reciprocal exchange systems, and earlier work based on different logics and currencies. Gregory Johnson (e.g., 1982) has shown that as the number of interacting decision-makers in a society increases beyond a certain point (often about 6) disputes erupt and decision performance degrades, presumably due to the stress of exceeding individual information-processing capacities. These stresses, he suggests, can be mitigated by formation of either sequential or simultaneous (hierarchical) decision-making hierarchies that reduce the simultaneous communications load. Johnson also suggested that decision performance decreases if the number of

interacting individuals is too small (1982:395). Kent Flannery (1972:410) recognized situations in which there is "too great a coupling among institutions on various levels"; following Rappaport, he called this "the pathology of hyper-coherence." Informal savings associations in developing countries, which are well documented in the anthropological literature, tend not to work as well as size increases, which also makes it less likely that the participants have close ethnic or social links.⁴

In light of the preceding discussion, it is possible to place these suggestions in a larger context that may apply to all complex adaptive systems. Very small groups, or societies with too few linkages among elements perform poorly because of the complexity catastrophe at $K=0$. Large groups having insufficient structures for canalizing interaction, exchange, and decision-making, and therefore too many linkages, perform poorly because of the high K complexity catastrophe. From this perspective it seems probable that societies are pushed-through processes of self-organization or selection, or both-into developing the structures associated with what we traditionally call "complex societies" as a way of avoiding the high- K complexity catastrophe when the population size of the interacting community passes certain thresholds (compare Kossel 1990).

The Limits of Metaphor

All metaphors have limits. Human communities are much more than very special cases of autonomous RBNs. Real societies have inputs from outside; those practicing "network-based" strategies (of dual processual theory) are especially sensitive to outside exchange, whereas those practicing corporate strategies are especially sensitive to climatic inputs that affect level of activity in internal exchange networks (Kohler and Van West 1996). In real societies

"wirings" among reciprocators are not random but are based on many factors including friendship, propinquity, and kinship (e.g., Kent 1993), and exchange responses can be graded rather than simply on or off. Human societies are composed of not just one kind of exchange network, but of many networks, which are constructed through consanguineal, affinal, age-grade, and many other logics. Finally, real people can change their "Boolean functions" and connections with other households on the fly; human networks scarcely stand still long enough to be analyzed.

In fact, what would happen if the elements in the network could roam around and find exchange partners who had something they needed, and needed something they had, instead of being stuck in an inflexible web of reciprocal duties and obligations to kin and neighbors? What if one could pick an exchange partner for, say, obsidian, that was different than for, say, corn or cotton? What if one did not need to use the same partner next time? What if one could find all these possibilities in a central place? All these are complications that are not easily accommodated by this model,⁵ but we think these are precisely the factors that are critical to explaining the huge organizational changes we see in some areas of the late pre-Hispanic Southwest. This is a pathway around the limitations on reciprocity that societies fell into during the Classic Period in the northern Rio Grande.

From Reciprocity to Markets

Many of the changes across the Late Coalition/Early Classic boundary in the Northern Rio Grande are fundamentally due, we suggest, to the growing influence of a market economy. Our argument does not require the existence of centralized marketplaces, although we suspect that these existed in or around the plazas of the largest towns; market exchanges may be dispersed. Following Pryor (1977:31-

33) we define market exchanges as transactions in which there is high visibility of supply and demand forces. Such transactions can be negotiated through barter (and would have been, in our case) and need not require money. In markets transactions can be accepted or rejected with few or no broad social repercussions, although trust and ongoing social interaction are sometimes important (Bowles 1998). There is openness to entering and leaving the market and participation is voluntary. Finally, prices can be either fixed or fluctuating.

Markets are apparently quite ancient in the Americas. On the basis of the regional distribution of ceramics from local workshops, Feinman et al. (1984) infer the presence of markets in the Valley of Oaxaca by Monte Albán I times (500-200 B.C.) Unfortunately, identification of markets—even in the context of marketplaces—is not entirely straightforward. The most recent and sophisticated attempt to develop indices of their presence is by Hirth (1998), who argues that a marketplace existed at the Central Mexican site of Xochicalco in the Epiclassic (A.D. 650-900). His argument is based on the convergence of several criteria, including configurational data on the spatial and architectural characteristics of marketplaces; contextual data which identify the sorts of conditions (such as full-time craft specialists and large cities) under which marketplaces are virtually certain; and distributional data, at the household level, on obsidian and imported ceramics. Hirth argues that a key characteristic of market exchange is that "households provision themselves independently of one another and without regard to broader social and political relationships.... The result is an increase in the homogeneity of material culture assemblages between households of different social ranks" (1998:456).

Archaeologists have been strongly influenced by unilinear cultural evolutionary models that associate markets with states. States in turn should have precursors in chiefdoms with redistributive economies. Nevertheless, Wilk (1998:469) reminds us that—

markets come in a variety of sizes and shapes ... there is no single market principle ... markets can be integrated into a remarkable variety of economic systems. Indeed, markets may best be seen as places where different kinds of economies—subsistence, specialized, simple-commodity-producing, elite gift-exchange—come together. From this perspective, they cannot be used as diagnostic markers of a single economic type or evolutionary grade.

Pryor, who defines markets somewhat generously, argues that all societies have some market exchange, although the importance of these exchanges is correlated with his index of economic development (1977:110). Interestingly for our argument here, Pryor suggests that markets are likely to become economically prominent earliest in societies that are characterized by monogamy and high participation of women in subsistence production (Pryor 1977:112), conditions that likely pertain to the Northern Rio Grande of Late Coalition or Early Classic times. Our own tabulation of the importance of markets in the same sample of non-hierarchical societies used in Figure 1, shows that the percentage of exchange activity involving markets generally increases, as expected, with community size (Figure 6).⁶ Market activity in this sample, which admittedly includes many societies in contact with states, becomes quite important at community sizes much lower than those achieved in the Classic Northern Rio Grande.

Consider for a moment the social landscape of the Pajarito Plateau of North-central New Mexico around A.D. 1200, populated by dispersed, mostly mesa-top, hamlets. (Many other areas could be substituted.) The three or four households in such units, probably related by consanguineal and affinal ties, certainly had dense internal linkages, on the order of $K=N$, and probably some sparser connections as well to other hamlets in the neighborhood. Continued immigration onto the Pajarito in the 1200s was at first accommodated by adding additional hamlets of this size, but by about A.D. 1275 a larger class of site begins to appear, locally called plaza pueblos. Burnt Mesa Pueblo Area 1, the only one of these to have been investigated systematically, was two stories high along its western roomblock and the adjacent portions of its north and south roomblocks, and probably housed a maximum of 20-24 households (Linse et al. 1992). This site

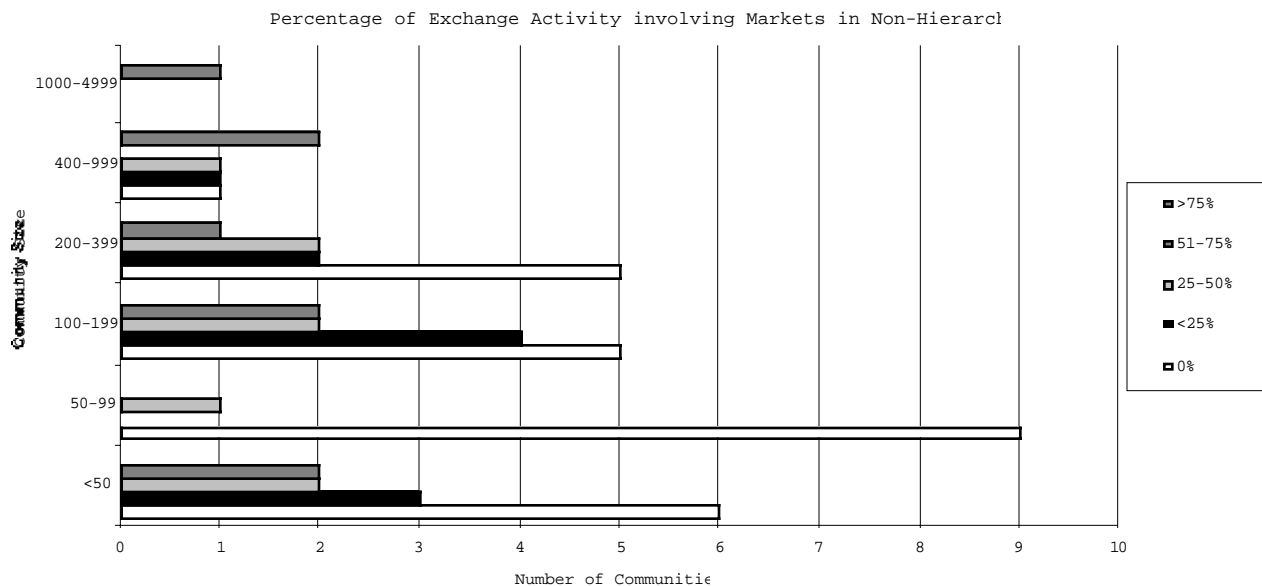


Figure 6. Percent of exchange activity involving markets in a sample of 54 non-hierarchical societies drawn from the Standard Cross-Cultural Sample.

class is short-lived, and represents the final local acme of dry farming of mesa-tops. By the mid-1300s, with the mesa tops possibly deforested (Huber and Kohler 1993) and eroding, most households further aggregate in or adjacent to well-watered valleys such as Frijoles Canyon. Farming becomes increasingly dependent on water-management techniques, and as these are worked out, they are most reliably and productively practiced along the Rio Grande itself, where, by the early 1500s, populations—by now in large aggregates—are almost exclusively residing.

Only an archaeologist can appreciate the richness and danger of the minefields negotiated in that brief summary, but let's not dwell on those, let's try to look at the big picture. The sudden appearance of sites in the plaza pueblo class almost certainly changed the N in the networks in which each household was embedded; what about the K? The plaza pueblo site plan, which is basically four small hamlets stuck together with a small plaza and a kiva in the middle (there is sometimes another outside to the southeast) suggests that the residents tried to maintain the older pattern of high connectivity within their modules (kin groups, roomblocks) and sparser connectivity between. We may speculate, however, that the relatively low identification of each kin group with the village that would result from such patterns might put such aggregates at a disadvantage relative to other villages that had somehow discovered an organization that, without burdening households with a higher K, placed more of that connectivity among rather than within kin groups.

Tyonyi-class towns of the Classic Period represent the winners in this competition. Gone or at least submerged are the modular kin-based architectural units. Direct historical approaches and traditional thought among Southwestern archaeologists would suggest that households now have labor and exchange

obligations within medicine and dance societies that crosscut kin lines, and sometimes pueblo lines, that are as salient as their obligations to kin. Our own analysis earlier in the chapter leads us to wonder if, in contrast to the earlier sites, balanced reciprocity at the level of the household could be effective as the dominant mode of exchange in communities of this size.

And yet Tyuonyi, with some 300 ground-floor rooms, is only a small town by the standards of the northern Rio Grande Classic period. The multiple adobe roomblocks and plazas of Sapawe, along the Rio Chama, may cover 29 ha (Cordell 1997:404). Schroeder (1979b:246) estimated that Acoma had 6000 inhabitants in Coronado's day and Pecos, 2000 (Schroeder 1979a:432).

There are abundant descriptions of the importance of trade among the protohistoric (\approx Classic period) Pueblo people of the Southwest. Riley, for example, emphasizes the variety and bulk of materials moving along corridors stretching from Hopi to Zuni and through the Tiguex province over to Pecos, and from these areas to California, Sonora, Chihuahua and the southern Plains (Riley 1995:113-132). It is generally recognized that the volume and variety of materials moving along these routes, and the distances they were moving, represent a distinct and dramatic change from earlier periods. Snow (1981) provides a detailed account of the materials traded and cites historical records showing that in some instances the mechanism of movement was long-distance trading parties. He also documents an increasing emphasis on trade in bison and bison products for corn, cotton blankets, and ceramics between the northern Rio Grande pueblos and Plains people beginning around A.D. 1400 (see also Spielmann 1991).

These exchanges are undoubtedly extremely important, especially since some theories for the origins of markets (e.g., Polanyi 1944) require contact between

different socioeconomic systems. We hear much less, however, about movements of goods within the Rio Grande. These are harder to see in the archaeological record, but even those that are visible are not adequately emphasized. Twenty years ago Snow (1981:364) noted that Shepard's 1930s discovery—that whole classes of pottery were being imported into some pueblos, while other pueblos specialized in making ceramic containers that ended up in the archaeological record at points both near and far—still had not been adequately digested by Southwestern archaeologists. This remains true today. What does the specialization in the production of a single commodity by whole communities tell us about the regional economic system? It is time to explore the probability that the northern Rio Grande economy of the Classic period was increasingly structured around, and by, market activity. Such activity would not have entirely displaced the older systems based on reciprocity, of course, but we contend that its consequences were nevertheless transformative. Markets thrive on, and encourage, very different kinds of relationships than do reciprocal exchange systems (Table 1).

A number of the characteristics of the late pre-Hispanic period in the northern Rio Grande could be (and have been) explained individually without invoking markets. Aggregation could be due to defense. Movement down into the Rio Grande trench and the Galisteo Basin could be explained by deforestation of the uplands, by climate change, or by the development of productive water-management techniques (as we did above). The presence of large plazas and the long-distance movement of some goods? Ceremonial demands. The apparent ease of accommodating new arrivals into the Rio Grande from the San Juan? Development of a new ritual system. The apparent decreasing importance of kin-group affiliation? You guessed it—new ceremonial organization.

Table 1. Contrastive tendencies of reciprocal and market economies.

Characteristic/ Effect	Reciprocal Economic Systems	Small-scale Market Systems
Relationship among transactors	Social and personalized; exchange primarily within socially defined peer group; relation- ships enduring	Often anonymous, crossing lines of kinship or social group (Hirth 1998); relationships ephemeral (Weber [1922]1978:636)
Nature of transactions	Transactions bundled with and channeled by social obligations (Mauss [1925]1967)	Transactions more free from social obligations or considerations
How exchanged materials are matched	Like for like (dominated by food)	unlike
Mode of production	Household mode of production dominant	Increasing importance of production for export and exchange
Ease of entry and exit	Low	High (Weber [1922]1978)
Prices	Not widely known outside of a specific exchange system; often fixed	Generally known and often negotiable (Pryor 1977:32- 33)
Household location	Access to subsistence resources a primary concern	Access to markets becomes a consideration (Smith 1976)
Household aggregation	May favor small aggregates under some circumstances (Kohler and Van West 1996)	Allows very large population concentrations (Muth 1975:28-31)
Volume of goods moved	Generally low (but see Allen 1984)	Higher
Variety of goods moved	Low	Greater
Distance of goods moved	Generally short, but somewhat dependent on level at which exchanging units are defined	Longer

Without invoking markets, however, it is somewhat less easy to explain the quite obvious new emphasis on production for exchange of ceramics (Habicht-Mauche 1995), of obsidian (Root and Harro 1992) and of cotton (Herhahn and Hill 1998) that marks the Classic period. More importantly, in their totality, the constellation of changes that we see clearly by the late A.D. 1300s in this area is most simply and fundamentally explained by the effects of increasingly

important market activity. Markets are transformative because they reduce the importance of kinship; they promote easier entry into and exit from communities; they ease acceptance of "stranger communities"; and they are stimulated by and in turn promote the development of craft specialization.

Furthermore, for at least two reasons, markets allow and promote the development of larger aggregates. Market exchange is usually more efficient than reciprocal exchange, enabling at least some (and possibly all) people to be better off without anyone suffering as a consequence. If by virtue of access to a market economy, a household with excess maize can exchange maize having low value (to it) for goods it needs (when it needs them) with another household which holds those in excess, then both have profited. Market access to goods may then raise the standard of living, which both favors internal population growth and attracts migrants from regions on the periphery of the market. We should consider the possibility that people come out of hinterlands (places like the Pajarito district) in part because they are attracted to the higher standard of living promoted by the strong Rio Grande markets.

Of course we should not ignore the probability that kachina dancers enlivened those large Classic period plazas. But let us not fail to consider that those spectacles also provided a wonderful opportunity for traders hawking everything from food to ceremonial paraphernalia at the plaza entrances. Toll (1985:370-389) summarizes the variety of economic activities surrounding current and historic Pueblo ritual gatherings.

Nor do we wish to propose that those traders somehow sponsored, even metaphorically, those festivals. More likely the new ceremonial system and new economic system were complementary and mutually reinforcing. (What better occasion to trade, than a large gathering of people come to dance or watch the

dancers? What better way to assure a large turnout for the dance, than to make it also an occasion to trade?) Perhaps they even had an historical connection and their local adoption was stimulated, however indirectly, by the same sources in Chihuahua and ultimately Mesoamerica, via the densely occupied corridors of the Rio Grande and the Rio Conchos. That possibility lies fortunately beyond the scope of this paper. Our point in this last section is simply that the rapidly escalating importance and impact of market exchange in the late pre-Hispanic Rio Grande has been virtually ignored in our conversations about the structural changes that we all recognize.

Some Remarks on the Papers

The economies of the Pueblo world up into the fourteenth century A.D. were probably dominated by reciprocal exchanges. This is neither a new nor a startling observation, but it may be that the structuring potential of such economic activity, and the norms that tend to accompany it, have been inadequately recognized.

For example, reciprocal economic systems would seem to resist the development of inequalities among members of the same network, and would probably resist, though less immediately and successfully, the development of great inequalities between members of different networks. They would seem to enhance the power of kinship and perhaps, by their relative structural inflexibility, be resistant to change in general. They would seem to have a tendency to grow Lego-block style, by sticking similar poorly melded units together until the construction falls apart.

Even the Chaco phenomenon, despite its size and complexity, seems to be an example of this model of organization. We agree with Wills when he suggests in this volume that the organizational work getting done at Chaco represents an

effort at communitas, a corporate-leadership-type effort to suppress competition. Even more specifically we agree with his view that the great houses were metaphors for this inclusive emphasis in Chacoan society:

A specific household in the larger Chacoan world could conceptualize its relationships with very distant households as being "like" its relationship with other households in its local pueblo. The religious elites of Chaco then, were "like" the respected elders of the pueblo, but with larger scope... (Kohler 1998:22).

How different seems the organizational basis of the protohistoric (Rio Grande) Salinas District sites considered by Graves and Spielmann in this volume. Absolutely rightly, in our view, they emphasize the appearance in this region of not just large pueblos, but of clusters of pueblos that collectively house several thousand people. They remark on the notable increase in intensity of long-distance exchange of decorated ceramics, obsidian, and cotton. They note little evidence for individual prestige and wealth accumulation despite population sizes that would suggest the development of leadership positions based on personal persuasion and influence. They remark on an intriguing pattern in which Gran Quivira enjoyed much greater access to bison and bison products than the nearby Pueblo Colorado, had a greater diversity of non-local ceramic materials, and much higher ceramic deposition rates. This pattern is interpreted, perhaps rightly, to indicate a pattern of competitive large-scale feasting that was more prevalent at Gran Quivira than at Pueblo Colorado.

We suggest an alternative (or possibly complementary) simple explanation for these patterns: Gran Quivira had the marketplace in the Jumanos cluster. The reason for the cluster of pueblos is that the other sites are located in

positions of compromise between access to subsistence resources and access to the market (Table 1). Gran Quivira has more bison products and a greater variety of non-local ceramic materials because these materials were brought there from many neighboring localities for barter to people from Gran Quivira and people from the other pueblos in the Jumanos cluster. The higher ceramic deposition rate probably does indicate that people from neighboring pueblos were coming in to visit, but were they feasting, or bartering, or both? Is the pattern of little evidence for individual prestige and wealth accumulation due to the tendency noted by Hirth (1998) for market exchanges to crosscut socially defined groups?

We do not suggest that towns like Gran Quivira were true central places for a completely integrated market system. More likely, they supported activities similar to the local markets that Smith (1976:46) reconstructs for the Tiv before they were connected to the Nigerian national system, when they seem to have been characterized by "few, poorly articulated trade gatherings whose locations and functions were variable and unstable" (though probably, in our case, linked to the ceremonial calendar).

It seems likely that the emerging market economy was weaker in the Zuni-Cibola region than in the Rio Grande, and still more so in the Hopi region, and that as a consequence (or, perhaps, as a cause of the poor penetration of markets) these societies retained more elements of the older kin-group organization, more elements of the reciprocal economy, and tended to solve the problems associated with growth through developing impersonal reciprocity based on exchange in accordance with role rather than in accordance with persona. (That is, the level at which the exchanging units were defined scaled up.) If roles were associated with kin groups, this of course leads to the possibility

of some concentration of power, within the limits of economies basically structured along lines of reciprocity. Keith Kintigh (this volume) notes that burial data from Hawikuh tend to support the inference that power was concentrated in religious offices available to only a select few of the resident lineages. Potter and Perry's chapter (this volume) notes the development of quite uneven final distributions of highly valued fauna, the fruit of communal long-distance hunts, among residential units at the Pueblo de los Muertos.

In passing, we note (even though it is not closely related to our thesis) that the ritual-symbolic differentiation between the circular and the square site plans that Potter and Perry contrast in the El Morro Valley is very strongly paralleled by the same contrast in the shape of Hopewellian ceremonial enclosures noted by DeBoer (1997). DeBoer links this opposition to a winter-summer distinction, which he ultimately assimilates, through a structuralist argument, to the (1969) Ortiz interpretation of the Tewa as "nervously poised between an egalitarian ideal and the danger of tyranny" (DeBoer 1997:236). It's a small world after all.

Conclusions

We have devoted a great deal of effort in southwestern archaeology to complicated models of political leadership and ceremonial organization. We also go to great lengths to reconstruct subsistence systems. Both types of endeavor certainly illuminate aspects of the archaeological record, but there is a missing middle that should link them. Our goal in this chapter has been to introduce a model that suggests the sorts of problems that settlements or communities may encounter with growth if their economies are structured primarily along lines of reciprocity (as we suggest was the case throughout the Pueblo world through the thirteenth century A.D.). The RBN metaphor suggests

that there should be fairly severe limits on the size of settlements operating through balanced reciprocity at the level of the household; we think these limits are in fact visible in community sizes cross-culturally and in the archaeological record.

We then proposed that the economies on the eastern periphery of the late pre-Hispanic Puebloan world were increasingly emphasizing market processes. This is not an entirely new argument; even though the word "market" is rarely used, it may be implied by the concept of "commodification" (Habicht-Mauche 1995). The consequences of this have not been appreciated, however. One of these is that markets reduce the importance of kinship. Several other aspects of the Classic period record in the northern Rio Grande that individually have been explained by resort to a variety of mechanisms may all be fundamentally connected to the increasing prominence of market activity.

Why should markets develop in the northern Rio Grande at this time but not earlier, or not elsewhere in the Southwest? A complete historical sketch would require another paper. The essential ingredients appear to have been the influx since the 1200s of many new Pueblo peoples, a process accelerating in the late 1200s; the increasing contacts with Plains peoples who were even less definable within the reciprocal framework than were the Pueblo immigrants; the fortuitous and simultaneous contact with new and possibly linked ceremonial and economic systems to the south providing models for reorganization; and the increased time demands of the small-scale irrigation and water-harvesting techniques practiced along the Rio Grande. Blanton (1983: 56-57) has suggested that the origin of market systems in Oaxaca should be understood "primarily as a consequence of the changing rhythm of work-time" as two-crop systems began to replace one-crop cycles. As a consequence, to use modern market jargon, households began to

"outsource" activities such as ceramic manufacture to more efficient specialists as a strategy to preserve some non-work time in spite of the new demands. In the northern Rio Grande case these demands also included the production of tobacco and cotton, difficult crops being grown either for the first time, or in much greater quantities than before.

We were initially surprised to see that the chapters discussed above provide more evidence for unequal distributions of power and wealth in what we infer to have been the more traditional kin-based reciprocal systems to the west, than in the societies increasingly dominated by markets to the east. Perhaps the power of market transactions to crosscut kin lines is initially a more powerful force than the ability of specific individuals to concentrate wealth in market economies. It may also be important that in our case, the economies dominated by markets were still quite young when they were disrupted by the Spanish. Finally, we might conclude that reciprocal exchange can be manipulated by ambitious actors to create dependencies along kin lines and ultimately visible differences in power and wealth.

We hope that this chapter stimulates more attention to the powerful structuring role of changing fundamental economic patterns that we think has been unduly ignored in recent conversations about pre-Hispanic Southwestern sociopolitical organization. It might also be worthwhile if it draws attention to the fainter lines of constraint that underlie all physical and living systems organized into networks.

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Footnotes

¹Relative importance of reciprocity refers to the relative percentage of extra-household procurement of goods and/or services conducted within the confines of reciprocity. Reciprocity is defined as obligatory (or quasi-obligatory) exchange of goods or services which is conducted regardless of demand existing on both sides. Reciprocity implies continued maintenance of the reciprocal exchange relationship and often implies previous interaction between exchange partners. In general, reciprocity here may be thought of as the obligatory two-way social exchange of goods and/or services, as opposed to one-way exchanges as with a potlatch. Community size codes are from Murdock and Wilson (1980).

²The majority rule provides the most exact model of a reciprocal dyadic system when $K=1$. In that case an element will be "on" (1) in the current cycle when its partner was "on" in the previous cycle, and vice versa. For larger K , the majority rule is only an approximate rendering of a reciprocal system, since an element will be "on" (or "off") for all its linked households at time $t+1$, even though a minority of those households may have been in the opposite state at time t . Such phenomena may happen, of course, in systems governed by delayed or indirect reciprocity.

³We attempted to assess variables such as N , K , and the length of time by which gifts given were separated in time from gifts received, in various

societies governed by reciprocity from materials in the HRAF, and in the Standard Cross-Cultural Sample (Murdock and White 1969). We were largely unsuccessful because these variables are not emphasized by previous theories, and are therefore not discussed or coded. Systematic work with primary materials is needed to assess the N and K parameters for a sample of societies.

⁴In developing countries, informal associations designed to save enough for exceptionally large purchases are good examples of the strengths, and limits, of small-scale reciprocal arrangements. Each participant puts a fixed amount of money into a pot at regular intervals, with the pot going to one member at a time, until each member receives the pot once. Default by members who receive their pots early are least likely when the associations are small (10-20 members) and the participants are known to each other (Besley, Coate, and Loury 1993).

⁵Although one could say, in a general way, that they tend to keep effective N and K low by defining them through transactions rather than through social relationships or residency.

⁶Relative importance of markets refers to the relative percentage of extra-household procurement of goods and services conducted within the confines of a market setting. Markets are defined as the immediate exchange of goods or services between individuals or groups in which such goods and/or services are valued and available according to demand. Market-based exchanges are ephemeral and do not imply long-term relationships (though some may in fact exist). In general, market activity may be thought of as the "free" two-way economic exchange of goods and/or services as opposed to one-way economic exchanges such as tribute or taxes. Community size codes are from Murdock and Wilson (1980). Presence or absence of money or "money-stuff" was disregarded in coding for reciprocity vs. markets. Money was present in about half of the

societies selected, but in general exchanges consisted of either domestically useable goods or subsistence items. Where token money (indigenous coins, paper money, etc.) or the currency of a nearby state was used, it was often in conjunction with other items. Finally, the use of money does not change the nature of the relationships that are still either social-obligatory or "free"-economic. Thus when we speak of markets or reciprocity in non-stratified societies, we are not implying "barter" or exchange of non-money items/services alone.

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