
Signaling Theory, Strategic Interaction, and Symbolic Capital¹

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Signaling theory provides an opportunity to integrate an interactive theory of symbolic communication and social benefit with materialist theories of individual strategic action and adaptation. This article examines the potential explanatory value of signaling theory for a variety of anthropological topics, focusing on three social arenas in which signaling might plausibly be important: unconditional generosity, "wasteful" subsistence behavior, and artistic or craft traditions. In each case, it outlines the ways in which the phenomena correspond with the expectations of signaling theory by showing how a given pattern of action might signal particular hidden attributes, provide benefits to both signaler and observers, and meet the conditions for honest communication. The ethnographic evidence suggests that the fundamental conditions for reliable signaling of condition-dependent qualities may exist in many social domains. It appears that signaling theory has considerable promise for generating novel and powerful insights into the ethnographic realm.

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Materialist and evolutionary analyses of subsistence, economic exchange, mating and marriage, and parenting have become increasingly sophisticated and detailed (see reviews in Smith and Winterhalder 1992, Wilk 1996, Voland 1998, Hill and Kaplan 1999, Cronk, Chagnon, and Irons 2000, Winterhalder and Smith 2000). The power of these analyses lies in the focus on individuals as strategic decision-makers and on empirically tractable measures of costs and outcomes. While this approach has had many successes, the more ritualized and communal aspects of social behavior, those that appear to be driven by cultural meaning and collective interest more than by individual gain, have proven difficult to explain.

We wish to argue that the ostensible limitations of the individual-strategist approach as currently conceived are due in part to an overly narrow conception of motivation and social interaction. While evolutionary and ecological anthropologists have rightly emphasized the importance of such components of adaptive success as food acquisition, mate choice, and resource competition, they have paid insufficient attention to social, symbolic, and prestige-related aspects of individual strategizing. These components of cultural behavior may appear to generate benefits that are unmeasurable or that favor social groups at the expense of their individual members, but recent empirical and theoretical work, as well as a long-standing body of social theory, suggests an alternative interpretation. Using "costly-signaling" or "handicap" theory, anthropologists, ecologists, and biologists have begun to integrate altruistic or seemingly irrational behaviors into adaptationist and strategic analyses of decision making and social behavior.

There also exists a long-standing parallel set of theoretical concepts in social theory dating back to Thorstein Veblen and Marcel Mauss and more recently refined by Pierre Bourdieu. For these theorists, individually costly but collectively beneficial (or at least prestigious) behaviors such as public generosity or extravagant piety are a form of social competition: the most generous or self-sacrificial individuals gain higher prestige, and the recipients or observers gain material benefit at the expense of their own prestige (Veblen 1994 [1899], Mauss 1924, Fried 1967). In its various guises, this approach has been known as conspicuous consumption, wasteful advertising, and the accumulation of symbolic capital. Our goal here is to show how these various evolutionary, economic, and social theories about communication and status can be unified within a single theoretical framework: signaling theory.

We believe that signaling theory can offer not only a

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rigorous and systematic framework for combining various convergent ideas about status competition but provocative new insights into exactly those domains of human behavior and culture that have appeared most resistant to adaptationist analysis. Signaling theory provides a way to articulate idealist notions of the intangible social benefits that might be gained through symbolic representations of self with more materialist notions of individuals as self-interested but socially embedded decision makers. By paying attention to the problem of how credibility is maintained when individuals have to make interdependent decisions (about mates, alliances, conflict, and trust) based on incomplete information, signaling theory provides a new interpretation of such symbolic performance as aesthetic elaboration, initiation rites, ethnic boundaries, ceremonial feasting, wealth circulation, conspicuous consumption, monumental architecture, religious commitment, and the individually costly provisioning of collective goods.

The paper is organized as follows: We first discuss the historical parallels in social and biological theories of signaling and summarize the structure of costly-signaling theory and the conditions under which it may be applied. We then turn to some ethnographic illustrations of its potential explanatory power. We focus on three likely arenas for signaling dynamics: unconditional generosity, “wasteful” subsistence activities, and artistic elaboration. We conclude with a discussion of the complexities raised in applying signaling theory to the explanation of cultural variation.

Conspicuous Consumption and Symbolic Capital

Thorstein Veblen’s theory of the leisure class first drew attention to the notion that wasteful expenditures of time and money and conspicuous displays of lack of interest in economic profit may function as a means of gaining competitive advantages over others. For example, Veblen wrote: “If, in addition to showing that the wearer can afford to consume freely and uneconomically, it can also be shown in the same stroke that he or she is not under the necessity of earning a livelihood, the evidence of social worth is enhanced in a very considerable degree” (Veblen 1994 [1899]:105). It is clear from this and numerous other passages that Veblen’s conspicuous consumption is a form of costly signaling wherein the underlying attribute being signaled is extraordinary wealth. Veblen proposed that signaling in this manner enhanced social status when knowledge of others’ qualities was not widely known or could be unreliable, as in situations of high socioeconomic mobility. This provided a ready explanation of the distinction between “old money”—the class of people who did not need to engage in such conspicuous displays because their wealth was already common knowledge (at least among those to whom they wanted it to be known)—

and the *nouveau riche*, who needed to advertise their newly acquired wealth.

Veblen also realized that variations in the cost or intensity of the display allowed fine distinctions to be made between individuals who are competing within specific social arenas for status and its perquisites (such as quality mates and powerful allies) (1994:32–33):

The greater the degree of proficiency and the more patent the evidence of a high degree of habituation to observances which serve no lucrative or other directly useful purpose, the greater the consumption of time and substance impliedly involved in their acquisition, and the greater the resultant good repute. . . . Differences between one person and another in the degree of conformity to the ideal in these respects can be compared, and persons may be graded and scheduled with some accuracy and effect according to a progressive scale.

Veblen focused on such “uneconomical” displays in order to draw attention to the shortcomings of classical economic theory, which presumed that what was good for the individual was also good for the group. His contribution to economic theory, while not widely recognized until quite recently, was to point out that the pursuit of self-interest, rather than leading to collectively beneficial outcomes, merely led to the waste of time and resources in elaborate social competition.

While Veblen focused on the social waste of conspicuous advertisement in capitalist society ca. 1900, Marcel Mauss tackled the conspicuous generosity characteristic of precapitalist societies with an eye to criticizing the notion that the benefits of such phenomena as the *kula* and *potlatch* lay in narrow economic notions of profit maximization. As Mauss was at pains to demonstrate, in such gift-giving systems transfers for immediate economic gain were “viewed with the greatest disdain” (1924:36). Confronted with seemingly irrational exchange behavior in which wealth transactions were immediately costly and did not seem to produce material gain and in which receiving wealth had to be countered with equal or greater giving in order to maintain status, Mauss concluded that conspicuous giving was based on a superstructural economy of prestige: “Nowhere else is the prestige of an individual as closely bound up with expenditure. . . . Consumption and destruction are virtually unlimited. . . . The rich man who shows his wealth by spending recklessly is the man who wins prestige.” Particularly in cases of intensified social competition, a chief could maintain political authority only through demonstrations of quality that put his rivals “in the shadow of his name.” Mauss, however, did not offer a theory of prestige at the level of the individual actor, instead claiming that the benefits of such costly generosity lay in the structural integration of culture. In this sense, he and Veblen offered very different theories of social status and conspicuous display.

Pierre Bourdieu’s *An Outline of a Theory of Practice* (1977) has reintroduced the individual strategic actor

into a theory of prestige via his concept of “symbolic capital.” Bourdieu argues that the accumulation of symbolic capital is just as “rational” as the accumulation of economic capital, particularly since such capital may be freely converted from one form to another, ultimately in order to gain advantages in the form of additional wealth, power, allies, and marriage partners. His critique of rational action does not pit idealism against materialism but rather broadens the concept of rationality to include the pursuit of social gains, specifically symbolic capital. For Bourdieu, the highest profits in symbolic capital can be attained when individuals act in ways that reliably demonstrate lack of interest in material acquisition by engaging in conspicuous consumption or conspicuous generosity. The value of the display in terms of its symbolic capital lies in the cost of the investment in terms of time, energy, or wealth (Bourdieu 1977, 1990; Turner 1991). Bourdieu explains that behaviors that appear at first glance to be economically “absurd,” such as purchasing an ox simply to show that one has surplus resources, actually enhance a family’s symbolic capital, their “credit of renown,” at a time when marriage negotiations are critical (1990:120). He argues that this “exhibition of symbolic capital (which is always very expensive in economic terms)” increases the family’s social standing by displaying the quality of its goods, which is in turn linked to the attributes of its members. The resultant high social standing allows the family to, for example, acquire powerful affines through marriage and additional material wealth and (in the Kabyle case at least) to demonstrate the ability of its male members to defend and preserve its land and women.

Bourdieu further refines the link between the individual attributes and the symbolic value of the display in *Distinction* (1984:281):

The objects endowed with the greatest distinctive power are those which most clearly attest the quality of the appropriation, and therefore the quality of their owner, because their possession requires time and capacities which, requiring a long investment of time, like pictorial or musical culture, cannot be acquired in haste or by proxy, and which therefore appear as the surest indications of the quality of the person. This explains the importance which the pursuit of distinction attaches to all those activities which, like artistic consumption, demand pure, pointless expenditure, especially of the rarest and most precious thing of all . . . namely, time.

The convergence here with Veblen is remarkable (Trigg 2001). For Bourdieu, as for Veblen, conspicuous generosity is no different from conspicuous expenditure: both are ultimately strategic actions designed to accumulate symbolic capital. Both involve significant costs which function to attach value to symbolic capital. Both scholars, and Mauss to a lesser extent, seem to have recognized this solution to the paradox of economically irrational behavior. The costs of such strategies are outweighed by the benefits gained through manipulating

social relationships with other individuals. The apparent paradox of wastefully expending time and wealth is dissolved if the cost of the display functions to ensure that only high-quality individuals can afford them at all. Thus, the signal value of conspicuous consumption is maintained by its costs; these costs in turn are the price wealthy individuals pay for prestige.

However, there are two elements missing from these early formulations of signaling theory. First, costliness is not always necessary to guarantee signal value. Some signals maintain symbolic value because they are indexically related to that which they signify: they are simply impossible to fake. For example, the head flattening practiced by some Native American tribes to distinguish the free-born from slaves was a reliable signal not because of its cost but because it could be performed only for children on the initiative of free-born parents. Second, while Bourdieu’s notion of symbolic capital explains how costs ensure honesty, none of these accounts of signaling theory explain why an honest display confers prestige. Why would it be to the benefit of others to defer to one who signals his or her social or economic superiority—in other words, why tolerate inequality?

The answer to this comes from the evolutionary-ecological theory of costly signaling, which notes that there are mutual benefits to be gained from truthful communication. Those seeking assurance that a given individual has sufficient personal resources or belongs to a kin group of sufficient resource holdings or productivity to qualify as either an equal or a social superior do not need to put their faith in words but can examine the evidence of deeds, such as displays of generosity or waste, that are too costly to be worth faking. More broadly, signal cost (actual or potential) can serve as a powerful means of guaranteeing honesty and thus allow observers to gauge the relevant hidden qualities of potential allies, mates, or competitors. Inequality is tolerated when signalers demonstrate their competitive superiority, and deference (or interest in the signal) provides greater benefits than resistance (or ignoring the signal).

The Evolutionary Ecology of Signaling

There are several approaches to the evolution of signals within contemporary evolutionary biology: the “runaway” approach, the sensory-exploitation view, and the costly-signaling or handicap approach. Although these approaches can be reconciled with a single broad theoretical framework (Kokko et al. 2003), they are distinct enough that we feel obliged to describe the first two before concentrating on the third. In the runaway approach, pioneered by Fisher (1930), relatively arbitrary observer preferences (e.g., for mates with showy plumage) that are correlated via genetic inheritance to signals (e.g., because offspring inherit both the preference and the signal) can lead to the elaboration of signals over evolutionary time as preferences and signals coevolve. While formal models show that the Fisherian runaway process could favor the evolution of signals with no adap-

tive value other than their effect in attracting mates (Pomiankowski, Iwasa, and Nee 1991) and the runaway logic can be extended to models of cultural evolution (Boyd and Richerson 1985), there is relatively little direct empirical evidence for such processes. The sensory-exploitation view of signal evolution shares with the runaway approach the assumption that observers have pre-existing preferences (perhaps evolved in other contexts) which lead them to be attracted to certain signals and that signals which "exploit" these preferences by being even more elaborate (so-called supernormal stimuli) can be favored even if they are relatively arbitrary or maladaptive (Ryan 1998).²

We focus on the costly-signaling approach here because its focus on communication, direct parallels with social theory, and attention to strategic action make it the most clearly relevant to anthropological contexts. As with signaling in social theory, costly-signaling theory involves the communication of attributes that are relatively difficult or expensive to perceive directly and that vary in quality, intensity, or degree between signalers (either groups or individuals). The fundamental problem addressed by costly-signaling theory is how individuals with partially competing interests may nevertheless mutually benefit from signaling these differences in quality. For this mutual gain to be realized, the two parties must find ways to guarantee at least partial honesty of the information they communicate. The fact that they do have competing interests would seem to lead inevitably to deceit, which in turn should cause signals to be unreliable and eventually ignored, thus leading to complete failure of communication. But in the real world, both routinely misleading signals and unconditional honesty seem to be relatively uncommon. The costly-signaling approach suggests that the persistence of reliable communication emerges from conditions ensuring that honesty is the best move in the game of communication: both players do better by cooperating (giving an honest signal or paying attention to the information) than by attempting to defect (lying about one's intentions or qualities or ignoring the signal).

This fundamental problem of reliable signaling can be illustrated with a classic example from the realm of non-human behavior. Many ungulates (deer, antelopes, etc.) react to a nearby predator by seemingly paradoxical behavior—displaying a prominent rump patch, leaping high into the air rather than running straight away, and so on. These actions are paradoxical because they seem designed to attract the predator's attention and act to slow the prey's progress in escaping. The paradox diminishes if these actions are viewed as signals from the prey that tell the predator "I have detected you, and I am in excellent condition, so it is a waste of your time

to chase me." If this is a truthful signal, the predator benefits by saving the energy expended in a chase that will likely be fruitless, and the prey obviously benefits by avoiding the cost of a lengthy and tiring escape (and perhaps the even greater cost of becoming dinner).

But why should such a signal be credible? After all, prey are not interested in benefiting their predators (or vice versa). It would seem that an antelope in standard condition (and hence a slower runner) would benefit even more from signaling that it was in good condition, in which case misleading signals would proliferate in the prey population until predators learned (or were designed by natural selection) to ignore them. The standard solution to this dilemma offered in signaling theory is that signal honesty can be favored and thus an "honest signaling equilibrium" maintained if the costs of signaling are structured in such a way that dishonest signals do not pay. One way in which this condition might be met in the predator-prey case is if predators "tested" such signals (e.g., by pursuing prey for a short distance or on some proportion of encounters). Then prey in poor condition would improve their chances of survival by forgoing the signal and devoting all their time and energy to (a) remaining inconspicuous or (b) running away directly once detected and predators would generally receive truthful signals. Empirical tests of these hypotheses (using data on African ungulates) indicate that most are well supported (Caro 1994, FitzGibbon and Fanshawe 1988).

The conditions for the evolutionary or game-theoretical stability of costly signaling can be specified as follows (for more technical analyses, see Grafen 1990, Johnstone 1997, Gintis, Smith, and Bowles 2001):

1. Members of a social group vary in some underlying attribute (physical condition, resource endowment, need, motivation) that is difficult or impossible to observe but could in principle be reliably signaled.
2. Observers stand to gain from accurate information about this variation in attribute quality.
3. Signalers and recipients have conflicting interests in the sense that successful deceit (e.g., appearing to be a fleetier prey, a more dangerous adversary, or a more attractive mate than is in fact the case) would benefit signalers at the expense of the recipients.
4. Signal cost or benefit (to the signaler) is quality-dependent (i.e., the marginal cost of the signal is negatively correlated with the signaler's quality or the marginal benefit is positively correlated with the same).

When these conditions are met, we can expect one or more "design forces" (i.e., decision making, subconscious learning, natural selection, or adaptive cultural transmission) to favor a system of communication conforming to the costly-signaling framework.

Costly-signaling theory appears to provide a coherent framework that ties together a host of disparate social phenomena and unifies some seemingly unrelated strands of social theory, but does it really have wide explanatory power in human affairs? While it is much too early to make a firm assessment, a preliminary survey suggests that it probably does.

2. Without the correlated inheritance element, however, there is no "runaway" process, and the evolutionary equilibrium is reached when signals match the preexisting sensory bias; considerable evidence for signal evolution via sensory exploitation has been collected among animal populations (Endler and Basolo 1998), and it is easy to imagine how this analysis might be extended to cultural phenomena such as advertising, propaganda, and pornography.

Signaling Theory and the Ethnographic Record

Signaling theory offers an intriguing opportunity for reconciling the strategic-actor and materialist approaches in the social sciences with approaches centered on meaning, social value, and ritual. While many social anthropologists have long recognized the role of symbolic capital in motivating individual behavior, they have generally been averse to both formal theory and quantitative empirical tests (i.e., to conventional methods of science). In turn, economic, ecological, and evolutionary anthropologists have been reluctant to include such factors in their analyses because of this very absence of a rigorous, testable theory describing how individuals might materially benefit from socially meaningful but economically costly behavior. Signaling theory allows us to address issues of symbolic value with rigorous empirical data and a set of testable predictions derived from a body of theory that is linked to individual strategizing and evolutionary dynamics.

To illustrate the utility of signaling theory, we examine three social arenas in which signaling might plausibly be important: unconditional generosity, “wasteful” subsistence behavior, and artistic or craft traditions. In each case, we outline the ways in which the phenomena plausibly correspond with the expectations of signaling theory, noting how a given pattern of action might (1) signal a particular hidden attribute, (2) provide benefits to both signaler and observers, and (3) demonstrate how signals of attribute quality remain credible. While such plausibility arguments cannot take the place of rigorous hypothesis testing, at this early stage of the application of signaling theory to ethnographic cases they are a valuable first step.

SIGNALING AND UNCONDITIONAL GENEROSITY

Sahlins’s classic formulation of reciprocity modeled it as a continuum ranging from exchanges which were “altruistic,” “disinterested,” and “unconditional” through those which were “mutualistic” and “balanced” to those which were purely “self-interested” or “unsociable” (1972:195). Sahlins’s model proved to be the source of a great deal of contention, particularly his notion of unconditional exchange. Many suggested that there was no such thing as a purely altruistic, disinterested gift; gifts which may appear unconditional and altruistic either provide benefits in terms of symbolic capital or prestige (as argued by Bourdieu), create and maintain social relationships or social structure benefiting both parties (as argued by Lévi-Strauss as well as structural Marxists), or are given under conditions of asymmetric need, with the expectation that a corresponding return will occur at some later date when the asymmetry is reversed.

This latter view was first modeled in evolutionary biology as “reciprocal altruism” (Trivers 1971) and given wide currency by computer simulation models showing a “tit-for-tat” strategy (cooperate if your partner coop-

erates, defect if your partner defects) to be quite robust compared with less friendly alternatives (Axelrod and Hamilton 1981, Axelrod 1984). Many researchers subsequently used reciprocal altruism as a way to explain the widespread practice among hunter-gatherers (and others) of widely sharing individually harvested resources, particularly meat from large animals. Sharing reciprocally is commonly explained in terms of the ecological benefits gained by reducing the risk associated with acquiring such productive but highly variable resources (Smith 1988). Pooling such resources smoothes out consumption variance for all participants, a considerable benefit when harvests are so unpredictable that individual hunters can expect many days or weeks to elapse between successes (Winterhalder 1990). Other benefits that might be obtained through the mechanism of reciprocal altruism include a sort of “health insurance policy”: food is shared with the expectation that in times of illness, when foraging is impossible, one can depend on one’s previous sharing partners (Gurven et al. 2000a, Sugiyama and Scalise Sugiyama 2003).

While these risk-minimization effects of food sharing are plausible and can be demonstrated to exist (Cashdan 1985, Kaplan, Hill, and Hurtado 1990), they may well be a welcome but unanticipated outcome of rather than a motive for food sharing. In any case, sharing in order to reduce risk or ensure future aid where no formalized insurance institutions exist poses a major dilemma for the giver. He or she must discriminate among those who receive, withholding food from individuals who will not return the favor in the future on the basis of the often noisy and ambiguous evidence of the past. If there is no discrimination against nonreciprocators, sharing entails a prisoner’s dilemma payoff structure (Smith and Boyd 1990) in which there are incentives to be among the recipients and not among the givers—to free-ride on the efforts of others (Blurton Jones 1986, Hawkes 1993).

The evidence for such discrimination (sharing conditional on reciprocation) is inconsistent. Detailed analysis does reveal patterns of conditional reciprocity in inter-household food sharing among several Amazonian Indian forager or forager-horticultural peoples (Ache living in permanent settlements [Gurven et al. 2001], Hiwi [Gurven et al. 2000b], Yanomamo [Hames 2000]). But equally detailed evidence suggests that lack of attention to a recipient’s past history or future probability of reciprocating is characteristic of food-sharing patterns in other widely distributed cases, such as the Ache of the Paraguayan forest while on trek (Kaplan and Hill 1985a), the Hadza of the East African savanna (Hawkes 1993, Hawkes, O’Connell, and Blurton Jones 2001), and the Meriam of Torres Strait, Australia (Bliege Bird and Bird 1997, Bliege Bird et al. 2002). In these cases (and others that have been described in less detail), at least some types of harvested resources are shared unconditionally with most or all members of the community, and some hunters consistently provide more than others while sharing more or less equally in the catch. These “altruistic” providers in fact enjoy higher social status and reproductive success than their less productive peers, de-

spite the absence of any conditional exchange of meat for these social perquisites (Kaplan and Hill 1985*b*, Marlowe 2000, Bliege Bird, Smith, and Bird 2001). Enhanced social status and its subsequent political and reproductive advantages could be the “selective incentive” (Olson 1965) that motivates certain individuals to provide collective goods.

This insight has led to an active debate about how to explain the undisputed fact of extensive food sharing in small-scale societies (Winterhalder 1996, Wenzel, Hoversrud-Broda, and Kishigami 2000). Two distinct types of explanations have emerged as an alternative to reciprocal altruism to account for unconditional generosity: (1) strong reciprocity, in which at least some individuals are motivated to punish free-riders irrespective of the costs to themselves as a consequence of a history of cultural or genetic group selection (Bowles and Gintis 1998, 2003; Boyd et al. 2003; Fehr and Gächter 2002; Gintis et al. 2003), and (2) “symbolic-capital” explanations, which emphasize the social benefits that successful individuals obtain as a result of their generosity (Boone 1998, Gurven et al. 2000*a*, Hawkes 1993, Smith and Bliege Bird 2000, Wiessner 2002, Bodenhorn 2000).

Costly signaling is a symbolic-capital explanation for such sharing that focuses on its benefits for both givers and receivers. It applies particularly to displays which are characterized by (1) the extension of consumption rights to multiple others regardless of their exchange relationship to the “giver,” (2) distribution or consumption in a social arena in which knowledge of the distribution is transmitted to multiple others, and (3) the dependence of the ability to produce the display upon some hidden attribute of the donor in which observers (who may or may not be recipients of the material donation) have a significant interest. These conditions occur most readily in contexts such as funerary rites (Smith and Bliege Bird 2000), big-game meat distributions (Hawkes and Bliege Bird 2002, Bodenhorn 2000), big-man feasting (Wiessner and Schiefenhövel 1995), Northwest Coast Indian potlatching (Boone 2000), and charity galas in capitalist society (Veblen 1994 [1899]). We will expand on the first of these, using ethnographic information from our own fieldwork.

Meriam funerary feasts. Funeral ceremonies are some of the most elaborate and important rituals in Melanesian societies. Among Meriam Islanders of Torres Strait, the occasion of any death engenders a series of expensive public ceremonies and feasting events. When a death is first announced, the deceased’s kin group (generally, a patrilineal clan) meets to select a leader for the events to follow and to elicit monetary contributions for mortuary expenses. The next day the *bood*, a public sitting near the deceased’s home attended by kin and others, begins. The immediate family is responsible for feeding all who come to show respect for the deceased and the kin group. Donations of food are made by kinsmen and others in the village, supplementing the hunting, fishing, and purchasing efforts of the immediate family. The *bood* lasts for several days, as long as the immediate family wishes to mourn publicly and supply food to all

comers (a form of feasting termed *bood lewer*). A temporary cross and grave are constructed at the burial site (one of several elements reflecting Meriam colonial history and conversion to Christianity in the late nineteenth century). At the end of the *bood*, a public funeral feast (*izurwur lewer*) announces the end of the formal period of mourning.

Roughly two to five years later, the family announces that the permanent tombstone is ready. These tombstones have developed into elaborate granite, tile, and concrete structures with color photos, engravings, molded reliefs of totems and fruits, and other expensive details. The family hosts a series of public work-party feasts to engage helpers to ready the grave, and a final public feast (*kirim akos lewer*) is held after the public setting of the headstone (*kirim akos*). Following this event, the date for the final “tombstone-opening” ceremony is set (the “opening” being an unveiling of the tombstone, which has been covered from view since the setting ceremony). This ceremony begins with public work-party feasts, which can start up to two months before the date of the penultimate feast. All those who come to assist must be fed by the immediate family. Theoretically the entire island population (over 400) could attend, though attendance by half or less is typical.

The tombstone-opening feast (*kirim auskir lewer*) features tables laden with bowls of cooked fish, turtle, shellfish, and other foraged, planted, and purchased items. Gifts intended for the guests such as sarongs, beads, and clothing are displayed publicly by tying them to the feasting *mood* (shade structure) or placing them in large containers constructed for the purpose. Gardening men who have managed to cultivate a particularly large (but woody and mostly inedible) yam, sweet potato, or bunch of bananas donate their goods to be displayed on special bamboo racks on the feasting grounds. Careful lists are made to ensure that representatives of all family allies are given gifts and seated at a special table. Feasts provide a large audience for many other forms of competition and display of skills, and contests involving top spinning, dart throwing, and especially dancing occur throughout the night.

The quantity and quality of resources displayed and distributed at public feasts is a direct indication of the number of feast contributors, the time and energy they have invested in working for the feast giver, and the production skills of those who contribute big fish, hunted turtle, or display yams. A feast giver with many strong allies is able to provide shade and comfortable conditions for the guests, to distribute huge amounts of elaborately cooked food to them, and to give them expensive material gifts. A feast giver gains in status when his allies provide prestige foods (mackerel, hunted turtle) or foods that take time to prepare (steamed manioc puddings, conch cooked in coconut milk). Men prefer to donate large packages of uncooked meat to public feasts, especially large pelagic fish, giant tridacnid clams, and sea turtles. Women also provide foraged foods for feasts, but their contributions tend to come in the form of smaller quantities of prized (often rare) foods that are

elaborately prepared. Some men do prepare feasting foods, but women in particular gain some measure of notoriety for their cuisine and the time they invest in preparation, while men tend to gain more from displaying their skill in acquisition (Smith and Bliege Bird 2000, Bliege Bird, Smith, and Bird 2001).

The Meriam to whom we spoke clearly do not view these feasts as instances of conditional reciprocity, in which guests are expected to repay the giver with another feast at a later date. Rather, they are viewed as expressions of the Meriam conception of generosity, which involves reference to *debe tonar*, a phrase meaning “the good way.” Following *debe tonar* is said to provide long-term benefits in the form of an enhanced social reputation as a “good person.” Subsistence decisions intersect with the aspect of *debe tonar* that incorporates generosity with food. Meriam do not approve of conditional sharing of “table food” (*derapeili*, “to share portions out”) between households following the harvesting of wild or cultivated foods. Likewise, there are social norms governing the provisioning of food to feasts: such foods are explicitly designated public goods (*kies*), open to unconditional consumption. To share contingent upon a return in kind is to share selfishly, and to reciprocate a gift freely given is to imply that the giver had selfish motives. *Debe tonar* states that such unconditional sharing is its own reward. A Meriam adage goes, “When you expect payment back, you don’t make a lasting impression.” Sharing selfishly is equivalent to not sharing at all; both are identified as *gobar*, “greedy with food.” While *derapeili* and *kies* sharing are explicitly unconditional, there are contexts within which conditional reciprocal exchange is considered proper: markets (*tama*), labor exchange (*irapu*, work-party feasts), ceremonial exchange partners (*wauri tebud*), and repayments (*bodomelam*) for use-rights to certain individually or corporately owned items (land or foraging areas or boats and tools).

How do Meriam feasts articulate with costly-signaling theory? Feasts involve a form of collaborative signaling wherein the members of a lineage, clan group, or other social collective cooperate to produce a display indicating some socially important attribute of the social group. In the Meriam case, the final tombstone-opening feast is organized by a corporation composed of consanguineal relatives who cooperate to elicit wealth contributions from individuals more distantly related to the deceased. There are two classes of recipients or signal observers or, as the Meriam would describe it, two circles: the inner circle of families related through marriage or alliance who are the intended recipients of the accumulated wealth objects and the outer circle of more distantly related people who receive only the accumulated bounty of feast food. As many Meriam describe it, the immediate function of honoring the inner circle is to reaffirm their close relationship even though the death of one of their lineage members has the potential to change the relations of power between them: “We honor a member of each family with gifts to show we have not forgotten them.” In this sense, the Meriam tombstone-opening

ceremony has some fundamental similarities with Kwakiutl potlatches as described by Boone (2000), but it differs in that it seems to be designed less to reinforce the status of a particular leader than to cement alliances between key patrilineages on the death of a crucial lineage member.³

We suggest that one function of investing in costly displays of wealth and resources through feasting is to signal lineage “strength,” which may be defined as the qualities of and cohesion among individual members. Here, cohesion is measured by the strength of the alliances between its members, as indicated by the labor they are willing to invest in building the feasting ground and the costs they are willing to pay to contribute both the monetary cost of purchasing and donating the gifts of cloth and other material items and the time/energy cost of acquiring or preparing particular foods. Signaling theory suggests that such reliable displays of cohesion should be particularly important following the death of a powerful and charismatic lineage member (Boone, personal communication). Indeed, among Meriam and, we suspect, in most other social groups, funerary displays are more expensive and extravagant for socially central, politically powerful, and highly prestigious elders than for youngsters or marginal adults. There are many attributes that lineage members might signal through feast contributions, among them their ability to invest time, to acquire costly or rare foods, or to give away wealth items. Elaborately well-prepared items indicate skilled female cooks with ample time, the provisioning of large fish and turtle and the display of large garden produce indicate the skills of male hunters and gardeners, and the display of quantities of wealth items indicate the overall wealth of the lineage. Signalers (feast givers) may gain enhanced political power through cementing alliances with more patrilineages the more wealth they give away and may increase their prestige through unconditional distributions of food. These in turn may increase purchasing power in the marriage market for unmarried lineage members as others seek to marry into a patriline associated with higher prestige and political power. Guests benefit differently depending upon whether they are members of the inner or the outer circle. Inner-circle members gain reliable information about the lineage’s intent to continue to ally itself with them (guaranteed by the cost of the wealth provided) and whether or not their children will make valuable marriage partners (as guaranteed by the quality and extent of both wealth and food items provided). Members of the outer circle may

3. This is not to say that such signaling is the only function of a tombstone opening: every death requires such ceremony in order to appease the spirit of the deceased. The tombstone is considered a “house” for the deceased, a place where he or she may be kept happy so as not to wander about among the living causing havoc. A more elaborate tomb is considered to provide greater assurance that the deceased will remain in one place, where he or she may be consulted from time to time for intercession on family matters. In fact, delays in construction of the final tomb often necessitate an intermediary feast wherein the family members publicly assure the deceased’s spirit that they are working on its “house” and that it will be ready by a certain date.

benefit by gaining information about the current state of political alliances in the community and may also use the honest information conveyed by the quality and extent of food provided to assess the hunting, fishing, or cooking skills of a lineage's marriageable members.

While we view the above account as plausible, we reiterate that more rigorous formulation of signaling arguments and empirical tests thereof are needed. We also make no claim that signaling theory is likely to explain all acts of unconditional generosity; in particular, acts carried out anonymously or secretly (such as sheltering Jews during the Holocaust) would be hard to explain as forms of signaling, calculated or otherwise.

SIGNALING AND "WASTEFUL" SUBSISTENCE ACTIVITY

Apart from the benefits of hosting a public feast, there is the distinct question of why individuals choose to produce goods for display or consumption in this or other public contexts. More specifically, why is it that men display their individual attributes by growing large yams or hunting turtles, for example? Materialist-oriented researchers have been reluctant to recognize that such activities are actually "wasteful" in a narrow economic sense. Especially in the case of the hunting of large animal prey, it is generally assumed that the main benefit accruing to the hunters is nutritional: either the hunters acquire more meat with less cost than with alternative prey or they benefit in the long term through conditional sharing arrangements. Here we discuss two examples of subsistence activities that do not appear to fit these assumptions and may be better explained using signaling theory.

Yam growing. Among many Melanesian societies, *Dioscorea* yams are the focus of men's gardening effort (Malinowski 1935, Lea 1964, Forge 1966, Kaberry 1971, Weiner 1976, Beckett 1988, Scaglione 1999). While men may sometimes compete to grow greater quantities of yams, they often concentrate on growing a few yams that are as large as possible. At lengths of up to 3 m, depending on the depth and quality of the soil, such yams are generally woody and inedible, suitable only as propagules for more yams and for display.

Among the Central Abalam of Papua New Guinea, the political nature of yam-growing competitions is overt (Forge 1970, Kaberry 1971). The Abalam plant two major types: long yam (*wabi*, *D. alata*) and hairy yam (*ka*, *D. esculenta/nummularia*). *D. alata* is the only variety of yam that tends to grow longer with additional care, attention, nutrition, and good soil, and *wabi* gardens are kept separate from *ka* gardens. A typical *wabi* garden, tended entirely by men observing taboos on contact with women, may contain around 30 long yams, whereas a *ka* garden, tended by both men and women, grows around 50 small *wabi*, 600 *ka*, and 2,000 taro plants (Lea 1964). The *ka* garden produce is destined for household consumption, whereas the large *wabi* in a man's garden are destined for display and ceremonial prestige exchanges. *Wabi* gardens contribute very little to daily sub-

sistence, even though they require more hours of labor per kilogram of yams produced: Lea provides data showing that in one village, planting long *wabi* yielded 4 lb. of yams per hour of labor while *ka* provided 37 lb. per hour. On average, men who planted *wabi* expended nearly twice as much time and effort (460 hours) on planting *wabi* as on planting *ka* (260 hours). A very long (2–4-m) *wabi* hole required on average 25–35 hours of labor to construct.

Each Abalam hamlet has a big-man who excels in the growing of long yams and knows the magic needed to grow them and who may or may not be its most senior elder. At harvest, the big-man assumes ownership of all the yams for which he has performed his magic: "There is a close identification between a man and his finest yam: it is a symbol of his manhood and his industry. Many of the longest yams are not eaten: they are displayed at harvest, stored, distributed, stored again, and eventually planted. . . . When a man dies, some of his yams are lashed to a mortuary frame by his grave and allowed to rot" (Kaberry 1971:41). Long yams are destined for use in ceremonial yam exchanges (Lea 1964, 1969) in which the best and longest yams are decorated with elaborate painted wooden masks, baskets, shell rings, feathers, and other accouterments and given to the exchange partner of the visiting hamlet. The exchange is accompanied by a day-long feast, displays of dancing, and "bombastic" oratory. By accepting the yams, the recipient obligates himself to match the display or else lose status, and the largest, finest yams may be rejected by the recipient, fearing that he may not be able to match their size or quality. Thus, although there is an element of reciprocity in relations with exchange partners, the fundamental dynamic is one of competitive display, as underlined by the fact that if the yam is rejected, the grower leaves the yam on display to rot rather than using it in another exchange and yet gains immediate prestige (Kaberry 1971:52):

Over a period of years he has established his reputation—one that is acknowledged by members of his hamlet, by the clan of his ceremonial partner, and by the village at large. . . . He is described as one who has a name: "This name man, man of renown, his *wabi* and *ka* are good. When he plants them they are abundant"; or "he is one who has harvested big yams." He has many garden plots and storehouses; he and his wife or wives produce a surplus of food for lavish distribution at feasts.

Differential success in yam growing is reflected not only in the length and weight of the yam but in multiple other attributes, including shape, surface quality, and hairiness. The length of the yam itself is partially a reflection of the skill of the grower but also may be a product of the genetics of the propagule (Richard Scaglione, personal communication). Men who are able to obtain pieces of a very long yam may have a greater chance to produce a long yam of their own; thus men seek to cultivate alliances with those who grow the longest yams in an

attempt to gain access to those propagules. It is the men who possess both skills and wide trade networks who are able to produce the longest yams. Big-yam men become high-status political entrepreneurs, using their trade contacts to thwart their rivals and pursue their political ambitions (Forge 1962, 1970).

Meriam gardening shows a similar pattern. Gardens are distinguished by their purposes: some are planted for display to gain prestige (*kies gedub*, “common goods garden”) and others for provisioning (*eroli gedub*, “eating garden”). Meriam men tend to plant primarily for prestige. Men’s gardens feature the same yam species as in Abelam (*D. alata*). Yams are grown primarily for display at feasts, for gift giving, or for trade. The labor a man puts into his display garden is substantial: each yam sucker is planted with great care and ritual attention, and each must have a custom-crafted hole as deep as possible (up to 1 m or more) so that the yam will encounter minimal resistance to its growth. In hard soil, each such hole takes several hours to dig and another hour to pound the soil fine so that the hole can be refilled and appropriately fertilized. Men subsequently devote considerable time and attention to their yams over the nine months they take to reach maximum size.

Like Abelam women, Meriam women plant primarily for “table” (household provisioning). They also plant *D. alata* yams in addition to hairy yams, but their holes are only 10 cm deep, they may plant 20 for every 1 that a man plants, and theirs reach an optimal eating size in four to six months. Such yams may sometimes be donated by women to public feasts as consumables but not as display items. Meriam gardeners speak explicitly of the tradeoffs between planting for prestige and planting for table. Aside from the fact that taking so much time to plant a single yam prevents one from planting many more small yams, large prestige yams are not only too woody to be eaten but too valuable to be eaten; thus one gardener was cautioned that the prohibition against women in a prestige garden was a practical one, else she would eat all the food in it before it had gotten big enough to display. Men also should not have sex with women while planting yams, but, as one gardener put it, “a man might be able to make up for his lack of women once he displayed his yams.”

But why does the ability to grow such large and uneconomical yams confer status?⁴ Meriam explain that one gains prestige not from a big harvest of table yams but from growing and displaying a single huge yam. For gardeners (and foragers), large harvests are primarily a prod-

uct of production time, whereas harvests of rare and big things take both additional time and skill. A Meriam man’s foraging and gardening effort is not a good strategy for putting food on the table but rather a strategy involving a display of skill and command of esoteric knowledge. The more skilled and knowledgeable a man is, the bigger and better his yams. As a result, he gains a reputation as a wise man (*lug asmer le*) or an expert (*luzap le*), and he demonstrates his store of supernatural power, *zogo* (benevolent) or *maid* (malevolent). The process of gaining and displaying knowledge (*saserim*) is the major pathway by which men gain social dominance (Beckett 1988). A man who demonstrates his command of ritual knowledge without divulging the nature of that knowledge gains much social attention and a measure of influence in public decision-making processes.

In big-yam competitions such as these, the attributes being signaled are esoteric or ritual knowledge and/or the ability to devote time to activities that are not directly productive (but in fact compete with food acquisition). The benefit to the signaler is enhanced prestige relative to other growers; qualitative evidence indicates that this enhances the signaler’s social influence. The benefit to observers of the yam competition is the acquisition of knowledge that will help them to make better decisions about whom to support in political maneuverings. Finally, the guarantee of reliability of this signal is the dependence of the size/quality of the yam on the time, knowledge, and political connections possessed by the gardener.

Turtle hunting. Meriam turtle hunting has been the object of a detailed examination of the ability of signaling theory to explain seemingly inefficient (and costly) foraging and food distribution patterns (Smith and Bliege Bird 2000, Bliege Bird, Smith, and Bird 2001, Smith, Bliege Bird, and Bird 2003). There are two primary types of marine turtle acquisition on Mer, hunting and collecting. Turtle hunting occurs primarily in the context of public feasting events: hunters choose to hunt in response to a request from feast organizers to provide turtles for consumption at a previously announced feast. Upon accepting such a request, a hunt leader will assemble a crew of several “jumpers” (young men who dive for the turtles and wrestle them live into the boat) and a boat driver (who takes commands from the leader) and spend a long day traveling far from Mer in search of free-swimming turtles. In contrast, turtles are collected primarily in the context of household provisioning but also for feasts by men of all ages, as well as women and children. Collecting occurs only during the nesting season (October through April), when egg-laying turtles can be harvested on local beaches with minimal effort and risk.

Turtle hunting is a competitive pursuit, with a very different complement of participants from collecting. Compared with collecting, hunting is more costly (in time, energy, and risk), provides meat less efficiently (because of higher travel, search, and pursuit costs), and is associated with wider distributions of meat (table 1). Hunters keep no meat for themselves unless (quite rarely) hunting for household consumption, in which

4. Boyd and Richerson (1985:269) proposed an answer based on a cultural analogue to Fisher’s runaway model in which the ability to grow larger yams served as an indicator trait of farming skills, leading others to grant these individuals prestige and copy this indicator trait. They argue that since those who most admire big-yam growers should be more likely to imitate the indicator trait, a positive-feedback runaway dynamic leading to even larger yams and even more prestige could occur. While this hypothesis has some similarities to the costly-signaling explanation proposed here, it does not explain why individuals who have no interest in growing large yams (e.g., women) would grant prestige or other social benefits to big-yam growers.

TABLE 1
Meriam Turtle Hunting and Collecting

Variable	Turtle Hunting	Turtle Collecting
Return rate, before sharing (kcal/forager/hour)	8,110	19,390
Return rate, after sharing (kcal/forager/hour)	-630	3,200
Consumer households per turtle	26.7	18.7
Portion kept by producer (kcal)	7,780	14,390

SOURCE: Bliege Bird, Smith, and Bird (2001). Figures are for nesting season only, as collecting is not possible in the non-nesting season; all differences are statistically significant ($p < 0.05$) except portion kept by producer.

case they still keep less and share more than turtle collectors. Hunters take on a variety of costs for which they are not materially compensated, including the time and energy for the hunt (averaging about 40 man-hours), money for fuel, and time organizing and preparing the hunting crew and its equipment prior to the hunt. The ability to bear such costs appears to be linked to hunter quality: because a hunt leader is an organizer and decision maker, his abilities peak as he gains skill and experience. The signals sent by hunting are also efficiently broadcast: hunts are associated with larger numbers of consumers and thus a broader audience overall than collections, even during the nesting season and during household consumption events (Bliege Bird, Smith, and Bird 2001).

The costs that hunters incur for providing turtle so generously for public consumption do not appear to come in the form of increased shares of collected turtle or other foods, as we might predict if risk-reduction reciprocity were structuring the payoffs for hunting. Those who acquire turtle (both hunted and collected) more frequently and share more widely or in greater quantity do not receive turtle more frequently than those who share less or not at all (Bliege Bird and Bird 1997). In addition, such generosity with turtle does not appear to be repaid with shares of fish or other foods (Bliege Bird et al. 2002). Thus, households of turtle hunters generate sustained net outflows of subsistence resources to nonhunter households.

The costly-signaling explanation of collective goods provisioning as applied to the Meriam turtle hunting case proposes that turtle hunters benefit from unconditional sharing because their harvesting success sends reliable signals about their quality to the community in which they will play out their lives as mates, allies, and competitors. Paying attention to such signals can benefit observers because the costs and potential for complete failure inherent in the signal guarantee that it is a truthful measure of the underlying qualities at issue: only those endowed with the skills necessary will reliably succeed and therefore be asked repeatedly to serve on crews or as hunt leaders. The benefits accruing to signalers (hunters) will depend upon the specific signal and

audience, but for hunt leaders they appear to consist of being deferred to by elders and gaining the benefits of a hard-working wife's labor (Smith, Bliege Bird, and Bird 2003), while for jumpers it is a means of establishing social dominance among peers and hence preferential access to various social resources, including enhanced mating success (table 2).

Additional ethnographic cases in which "wasteful" subsistence practices appear to yield signaling advantages have been documented. For example, Sosis (2000) has used signaling theory to explain why men on the Micronesian island of Ifaluk engage in torch fishing for dog-toothed tuna even when other fishing patches, particularly yellowfin tuna, are more productive on those days. His results suggest (p. 243) that torch fishing is a reliable signal of work effort widely observed by members of the community and that the benefits gained by signalers are likely related to increasing the status of the matrilineage as a whole. Sosis suggests (p. 293) that signaling displays of quality may be increasingly important where ecological constraints limit the amount of honest information others can obtain about potential mates, allies, and competitors.

ARTISTIC ELABORATION

Artistic expression is a human universal dating back to the origin of our species. While signaling theory can be fruitfully applied to the full range of artistic production—music, dance, oral and written literature, and the plastic arts—we focus on visual artistic or craft traditions. In nearly all human societies, people devote a considerable amount of time and effort to decorating otherwise utilitarian objects (clothing, pots, baskets, tools, dwellings, etc.), as well as their own bodies. They usually also produce nonutilitarian objects used purely for decoration or as wealth objects, as well as aesthetically elaborated magico-religious paraphernalia. Anthropologists and biologists have begun to use signaling theory to explain the adaptive significance of this artistic elaboration (e.g.,

TABLE 2
Demographic Measures of Meriam Men (Turtle Hunters versus Nonhunters)

Variable	Turtle Hunters (n = 53)	Nonhunters (n = 61)
Age (study sample)	35.2	36.2
Age at first reproduction	23.9	25.3
Surviving offspring by age 50	4.0	1.7
Mean number of mates	0.76	0.46
Proportion of "hardworking" mates	25.0	9.9
Age differential with coresident partner (man's age minus woman's age)	3.6	0.1

SOURCE: Smith, Bliege Bird, and Bird (2003). All differences are statistically significant except age.

Kohn and Mithen 1999, Miller 1999, Hagen and Bryant 2003), though rigorous empirical tests are still lacking.

Bowser (2000) has extensively analyzed ceramics currently produced by a mixed Achuar-Quichua community in Ecuador. Efforts at fine craftsmanship and aesthetic elaboration are concentrated on bowls used for serving visitors, especially those for *chicha* (fermented manioc beer). Achuar and Quichua women “are respected for their excellence in making and painting *chicha* bowls,” and “both men and women say that making *chicha* bowls is one of the most important aspects of a woman’s role” (p. 227). While it is impolite to do so publicly, in private potters readily criticize others in terms of the thinness of the bowl walls, the fineness of the painting, and the aesthetics of design elements. For married women particularly, bowl quality thus indicates the skill of the potter.

A woman who makes finer pots may gain social benefits in two ways. First, skilled potters may be able to secure better marriages—marriages to men who are politically well connected. Indeed, at least some level of ability in crafting locally acceptable pots is a prerequisite for marriage, since “competence in painting pottery bowls is a marker of a girl’s transition to marriageable age” (Bowser 2000:227). Second, married women continue to produce pottery that signals both their skill and their political alliances. This is because fine bowls are admired by men and women desiring to impress important visitors and thus expand their network of political alliances. The design of *chicha* bowls is shaped by the twin, often competing demands to maintain a style that indicates group membership and political alliances and demonstrate enough individuality to gain and maintain a reputation as a skilled potter.

We propose that the audience and the nature of the signal sent by the potter through the aesthetic quality of the pottery change over a woman’s life course. She may begin with signals of skill: symmetry (challenging in these hand-coiled pots), wall thinness, delicacy of decoration, and the like. These may indicate intrinsic qualities (fine motor control, cognitive abilities, etc.) or signal time devoted to developing these skills (itself a measure of time available for investment in nonsubsistence activities). Ceramic quality is a credible signal of the potter’s ability, since the relevant attributes of symmetry and fineness vary quantitatively as a function of skill. More skilled potters make more attractive marriage partners and thus have increased opportunity to belong to a stronger political faction and have better alliance partners than less skilled potters. After marriage, women continue to demonstrate their skill to potential allies in order to strengthen their existing political alliances and create new ones. It is in the best interest of others to ally themselves with a skilled potter because she already has a superior alliance through marriage.

Many other cases show similar features that suggest the broad applicability of signaling theory to the arts and aesthetic design. Wiessner’s studies of beaded headbands among the Kalahari San is a good example. Wiessner reports that “of 48 women who gave a reason for in-

vesting stylistic effort in beadwork, 42 (88%) mentioned a desire to impress the opposite sex, 37 (77%) to promote reciprocal relations” (1984:204). As in Bowser’s pottery study, we see here that women, not just men, actively signal to potential mates and allies and that artistic effort and skill appear to be important means by which individuals attempt to distinguish their qualities from those of others.

Signaling theory suggests that stylistic traditions in the arts exist in part to highlight individual variation in skill, much as conformity to routines in gymnastics or other sports facilitates observer discrimination of skill differences between competitors (Zahavi and Zahavi 1997). Thus, “decorative styles might converge on common standards in order to facilitate invidious comparison within the group” and, ironically, conformity might actually be a result of individuals’ attempting to distinguish themselves from each other (Boone, personal communication).

OTHER DOMAINS

Signaling theory has explanatory promise in a variety of other ethnographic domains that, for lack of space, we can only briefly mention here.

Religious ritual and commitment. Costly-signaling theory is increasingly applied toward an understanding of religious ritual (Boone 1998, 2000; Irons 2001; Sosis 2003; Sosis and Alcorta 2003; Sosis and Bressler 2003). Participation in religious ritual can serve as a costly signal of commitment to provide a collective good to members of one’s religious group under circumstances in which individuals seeking short-term gains would be tempted to defect. The costs of ritual observances include time (e.g., attending services), resources (e.g., financing communal rituals), and, in more intensive forms (handling venomous snakes, walking on coals, engaging in prolonged fasts, participating in communal violence, and the like), risks to the life or well-being of the participant. Signaling theory prompts the hypothesis that by paying these costs individuals signal to others that they are indeed committed to long-term collective action in a social group. Signal cost helps secure this commitment if a defector would not find it worthwhile to pay it, whereas a committed individual will recoup it through group membership over the long run. Alternatively, costly ritual may demonstrate the signaler’s ability to “waste” time or resources, as in other forms of conspicuous expenditure (Boone 1998, 2000). This explanation may best fit cases in which individuals choose to sponsor particularly expensive rituals or religious displays (e.g., the ostentatious churches of Renaissance Italy).

Monumental architecture. One of the first anthropological applications of costly-signaling theory analyzed monumental architecture in Mesoamerica as a costly advertisement of political quality by elites attempting to intimidate their rivals (Neiman 1997). Neiman hypothesized that Classic Mayan monument size and complexity should scale with the intensity of payoffs to advertisement and therefore factors such as recency of

migration into an area (which predicts less knowledge of relative competitive ability of neighboring polities) should spur intensified monument construction. His analysis suggests that variability in signaling intensity is related to ecological conditions that spur migration, concentrate audiences, and enhance differences in quality between individuals, here primarily elites controlling resource catchment areas (see Boone 2000 for a similar argument applied to Kwakiutl potlatching). The spatial scale at which cycles of monument construction and abandonment occur then provides an estimate of the scale of political competition, and the figure Neiman derives from the costly-signaling analysis matches the one that epigraphers have derived independently from emblem glyphs. In general, given its obvious utility in reliably advertising wealth, control over labor, and hence military and economic power (Trigger 1990, Kohler 1998), monumental architecture seems likely to provide fertile ground for application of signaling theory (for a counterargument, see Aranyosi 1999).

Embodied handicaps. Finally, there are plausible grounds for expecting signaling theory to illuminate costly and often seemingly irrational forms of bodily modification, ranging from tattoos and scarification to genital cutting (male and female) and footbinding. Some preliminary research has explored the hypothesis that bloodletting and intensive forms of body modification may serve to test nutritional status or immunocompetence in environments with high rates of pathogens (Ludvico and Kurland 1995, Neiman 1997, Singh and Bronstad 1997). Alternative hypotheses exist for these practices, of course, ranging from providing irreversible markers of ethnic affiliation to heightening the emotional impact of initiation rites, and we do not necessarily expect signaling explanations to be the sole or even predominant explanation for ritualized bodily modification. Here we simply argue that some of these practices do plausibly fit the criteria expected for costly signaling as strikingly embodied handicaps that signal socially relevant aspects of the bearer's quality. In some instances, such as Chinese footbinding, historical evidence indicates that the practice began as a way for high-status individuals (in this case, elite concubines) to differentiate themselves from social competitors as women of leisure. It then spread via competitive emulation to all but the poorest peasant classes, who could not afford the reduction in female mobility (and thus field labor) it entailed (Stevan Harrell, personal communication; Gates 2001). As in other domains, much further research is needed to subject these plausible scenarios to rigorous empirical test.

Broader Implications

Having surveyed a number of heuristic ethnographic examples in which signaling theory appears to have potential explanatory value, we now turn to a set of broader issues raised by this exercise. First, we discuss some issues raised when one applies a theory such as costly

signaling to cultural phenomena and to processes that involve individual agency as well as cultural or genetic inheritance. Second, we briefly consider what factors might shape variation in both the form of signaling displays and the intensity of signaling that might occur in any particular case. We then consider the contributions of signaling theory to an understanding of prestige-based hierarchy, group-level signaling, and gender differences in signaling. Finally, we discuss some common misconceptions about costly-signaling theory.

CULTURE AND SIGNAL EVOLUTION

The first set of issues is in part a question of causal mechanisms and should be familiar to all evolutionary anthropologists. What does it mean to say that the same theory can explain genetically evolved morphological characters such as peacocks' tails or infant body fat (Hrdy 1999), contingent behavior such as gazelle stotting or hosting a feast, and ritualized behavior such as the courtship behavior of a waterfowl or the display of a giant yam? These putative examples come equally from human and nonhuman realms; the issue of "genetic" versus "nongenetic" signal origins does not demarcate humanity from other species. Nevertheless, even a casual survey suggests that the displays produced by the human animal arise from individual agency and cultural inheritance to a vastly greater degree than is the case for other species. What is the explanatory significance of this difference?

One issue concerns the role of inheritance (genetic or cultural) versus contingent behavior. When a peacock matures and grows an extravagant tail, there would not appear to be much room for individual strategizing. For humans, however, it appears that strategizing, context-dependent behavior, and other forms of contingent signaling are common. We find it remarkable that the rules that govern the (genetic) evolution of signals such as peacocks' tails and gazelle stotting seem to have such promise in explaining human signaling behavior which varies independently of genetic *change*. We propose that this convergence is due to one or both of the following forces: (1) the role of genetically evolved preferences or predispositions in guiding human decision making, as argued by a variety of theorists (e.g., Irons 1979, Durham 1990, Tooby and Cosmides 1992), and (2) adaptive cultural evolution (Boyd and Richerson 1985, 1995; Durham 1990). In other words, signaling systems that are adaptive (fitness-enhancing) may arise either through the action of evolved psychological mechanisms or via a process of cultural evolution. There is, of course, no guarantee that either process will always produce adaptation, but there are ample reasons (discussed in the cited literature and elsewhere) for supposing that often or even usually this will be the case (though this must remain a primarily empirical question).

The relation of cultural evolution to other forms of behavioral adaptation is the subject of an ongoing debate (recently reviewed by Laland and Brown 2002). We can offer two brief contributions to this debate here. First,

we expect the very nature of signaling to entail a larger role for cultural evolutionary dynamics than might be the case in some other domains of human behavior. Since signaling is inherently social, requiring coordination of senders and receivers, any one individual has relatively limited ability to impose novel signals. This set of conditions may encourage the cultural evolution of signals based on conventional meanings that are *relatively* independent of genetically evolved constraints. If we may paraphrase Marx, while people creatively fashion their own signals, they do not do so with materials of their own free choosing.

Second, while we have no doubt that cultural traditions shape signal evolution, people seem to be able to innovate new signals rapidly, without too much cultural inertia. Some of this innovation seems clearly tied to changes in costs (and hence signal value), as in the rapid demise of lace making as a signal of high status with the advent of machine-stitched lace (Zahavi and Zahavi 1997) or the reversal of the status value of suntanned skin following the shift from agrarian to factory/office labor in Europe and North America. Other innovations seem to arise and spread for relatively arbitrary reasons, as seems to be true for much of fashion (be it tribal or postmodern), but further research is needed to determine what relation to signal cost, condition-dependent quality, and observer benefit such seemingly arbitrary shifts may involve. In sum, the cultural evolution or epidemiology of signals is an undeveloped area of empirical research and promises to be a complex and fruitful topic.

Ultimately, the evolution of signals is a matter of the differential replication of information (cultural and genetic), as determined by the effect of this information in the material world of living things and their environments. That humans have added cultural information to the genetic information replicated in the lineages of other species is a strange and wonderful thing. That signaling theory can illuminate the evolution of signals in both realms is both surprising and exciting.

CROSS-CULTURAL VARIATION

What determines cross-cultural variation in the arenas in which signaling is important? What determines cross-cultural variation in the amount of signaling in any one arena? There is no doubt that investment in costly display varies cross-culturally, in intensity as well as in form. The received wisdom is that richer environments create less pressure for strict economic utility maximization, allowing more time for symbolic or “wasteful” pursuits such as art, ceremony, and pursuit of prestige. Yet in one of the harshest environments inhabited by humans, the Great Sandy Desert of Western Australia, hunter-gatherers invest huge amounts of time and energy in seemingly “wasteful” religious ritual (Tonkinson 1991). While such ritual no doubt has a practical aspect—that of facilitating spatial memory of important water sources, foraging patches, tool sites, and the paths linking these economically important sites—the sheer elab-

oration of initiation ritual, including bodily mutilations and rigorous physical and social tests, suggests that the symbolic display value is equally if not more important. Likewise, it would seem that if hunting large, evasive animals is a display of skill, environments lacking such animals should promote a more narrowly efficient hunting strategy. Yet even here, where kangaroo and emu are extremely rare, men still prefer to hunt them rather than the more plentiful lizards and small mammals (Bliege Bird and Bird n.d.).

Rather than looking for broad correlates between intensity and form of signaling and some ecological parameter, it may be more fruitful to examine how the social environment creates or constrains competition in specific social domains. Signaling that is primarily about attracting mates should covary with the social and ecological factors shaping mating opportunities: where either serial monogamy or polygyny is common, signaling (by both males and females) should extend over a longer portion of the reproductive life span than where prohibitions on divorce or polygyny constrain opportunities for remarriage. When endogamy rates in a local community are high, information about the qualities of prospective mates should be relatively abundant and signaling therefore less intensive than when mates come from other communities. These and similar hypotheses appear eminently testable.

Signaling that primarily concerns competition for political influence should similarly covary with the opportunity for mobility within the local or regional sociopolitical system (greater mobility leading to more intensive signaling). One of the more important factors here may be the benefits and constraints involving the creation and perpetuation of prestige hierarchies.

A SIGNALING THEORY OF PRESTIGE

Boone (1998) was one of the first to propose that signaling theory could explain why costly displays establish or reinforce social status. By using conventional signals such as ceremonial sponsorship or magnanimous behavior to advertise their resource-holding potential, signalers can resolve conflicts before they rise to costlier levels involving direct conflict. Boone and Kessler (1999; Boone 2000) further refined the argument to show that the long-term benefits of achieving high status may be realized by lineages that accumulate this status and exploit the prestige deference they achieve from it to gain priority of access to resources during periodic downturns in the economy (e.g., due to drought).

Prestige is sought through competition, but not just any type of competition will do. Prestige competition often seems to focus on activities with unambiguously ranked outcomes that depend upon participant skill or other hidden qualities. Men gain prestige and other advantages through killing more rivals than other men (Godelier 1986), growing more (Weiner 1988) or bigger (Kasberry 1971) yams, giving away more food or goods at feasts or engaging in ostentatious displays of wealth (Kroeber and Gifford 1949, Codere 1950), gaining more

powerful ritual knowledge (Godelier 1986, Stanner 1966), or hunting more successfully or productively (Kaplan and Hill 1985a, Godelier 1986, Altman 1987, Wiessner 1996, Bliege Bird, Smith, and Bird 2001, Henrich and Gil-White 2001). Competitive efforts of these sorts contribute to the prestige quest because they provide effective signaling media, that is, they allow reliable communication regarding differences in intrinsic quality between competitors. In each case, certain characteristics of the prestige-generating activity affect relative success so as to reveal the competitors' levels of intrinsic skill or other socially valued attributes. Activities with high "signaling potential"—those suited to the broadcasting of reliable signals that benefit both observer and signaler—should be preferred. Such activities permit observers to discriminate skill levels among competitors and draw the attention of competitors (and potential mates or allies).

These "games of skill" provide arenas for honest signaling that "games of chance" lack. The outcome of a top-spinning game played by Meriam men depends importantly on the top-making abilities of each competitor. Men make their own tops from round bean pods or grind a sandstone top from local stone (Haddon 1935). The signal sent by Meriam top spinners concerns their ability to construct a perfectly balanced top, a feat that requires cognitive and manufacturing skills to transform an irregularly shaped object into a perfectly symmetrical one and then locate its exact center for placing the spindle. It may also (or alternatively) signal the spinner's ability to generate sufficient surplus as to devote many hours to the construction of and practice with stone tops. Such skill or surplus is not revealed if top spinners merely compete to spin manufactured tops, for there is then no intrinsic link between the length of the spin and the stone-working ability of the spinner. Likewise, top spinners maximize the information-carrying capacity of the signal by eliminating as many randomly generated externalities as possible: competitors create wind-hoods to keep a sudden gust from interfering with their top's spin, use a broken piece of glass as a spinning surface to remove any differences due to friction, and damp down vibrations from overly enthusiastic onlookers with a bed of sand.

Competition over food production is the most ubiquitous form of status competition, occurring among those who hunt and gather as well as those who garden. Of the many characteristics of food production that might provide reliable measures of producer quality, we propose two highly observable indices: failure rate and harvest size. These can be reliable signals if they (1) are significantly linked to intrinsic qualities of the producer relative to extrinsic producer-independent forces or simply producer effort and (2) vary significantly among producers in such a way that observers can reliably distinguish those who average fewer production failures or larger harvests. In cases in which failure-rate or harvest-size differences among producers show little variation, observers may be able to discriminate only broad skill levels, and prestige-based hierarchies will tend to be shal-

low and relatively egalitarian. If between-individual differences in failure rate or harvest size are great, observers may be able to rank producers ordinally. If skill levels (and associated production outcomes) remain consistent over time, we might expect strong, stable prestige hierarchies to develop, with proportionally less investment in signaling.

Our argument suggests that the evolution of hierarchy is constrained by the nature of the production system, specifically the relation between productive resources and producers' skill differentials. The fairly egalitarian political organization observed in most hunter-gatherer societies may thus be due in part to the very shallow and inconsistent or noisy (due to extrinsic factors) differences in foraging success between individuals (Hawkes 2000). When resources become more predictable in space and time, making differences in harvest methods and in resource defense prime determinants of variation in productive output, stable prestige differences should appear. As status competition intensifies in such systems, competition may shift to control over labor and exchange goods, and signaling games may be elaborated to display differences in these attributes.

A clear example of these trends occurred in Northwest Coast Indian societies (Ames 2001, Bishop 1987, Donald 1997). Here, each house group was headed by a chief, who (along with his close relatives, members of the titled nobility) claimed inherited and supernaturally sanctioned rights to prime fishing and gathering sites (particularly salmon streams) and directed the harvest and disposition of these resources. Northwest Coast chiefs and other nobles generated wealth and associated power and prestige in three main ways: by controlling the production of the commoners and of slaves (the latter owned by nobles) residing in their house group through near-monopoly of trade with other groups and by supporting craftsmen to produce wealth objects and ceremonial items (weavings, carvings, totem poles, dance costumes, etc.). But the Northwest Coast nobility had very limited coercive power over commoners and craft specialists and indeed had to compete with other house groups to attract the most industrious and skilled of these. This was done by signaling house productivity and resource holdings via bestowal of wealth and food gifts in often vast quantities, typically as part of marital alliances or at the potlatches held to mark major rites of passage of nobles (such as births, deaths, and marriages). While one could not generally become a chief or other title-holder simply by engaging in such wealth displays, one had to engage in them to validate noble status. Those who had the right mix of productive fishing sites and trade networks, sufficient labor, and political acumen could produce more frequent and elaborate displays and thereby attract even more industrious commoners, warriors to capture slaves and booty, and strategic allies, thereby increasing their regional standing in a positive feedback cycle. Although slaves had no say in whom they belonged to, most of the other participants had some choice in where they lived and whom they supported, and signaling via wealth dis-

plays and transfers played a crucial role in shaping such choices.

GROUPS AND INDIVIDUALS

Signaling theory in the social realm has tended to focus on the symbolic capital accruing to groups as a result of signaling by members, while theory in evolutionary ecology tends to focus on the benefits to individuals. There is no reason to suspect that one or the other must take precedence: individuals may often signal competitively in order to gain benefits for themselves and may also cooperate with other members of a coalition or social group to signal group attributes to other such groups. In many cases, the two levels of signaling may be intertwined (as in the Meriam feasting complex described above, for example). Although group-level signaling is in principle amenable to the same sorts of analyses as individual signaling, it raises several important issues.

Collective action problems. To the extent that members of a group have different interests, there will be conflict over who will pay the cost of group-level signaling. In the case of feasting or some other signal of coalition strength or cohesion, the signal intensity will be maximized if all members of the lineage contribute to the production of the signal; but if the signal will be produced even if some fail to contribute, there will be temptation to free-ride on the signaling efforts of others. Undoubtedly, if many individuals choose not to contribute to the signal, the feast will be noticeably poorer and the status of the lineage will suffer. This collective action problem (Olson 1965) must be solved to avoid failure. One solution would be a system of monitoring and punishment of slackers (though this itself raises a second-order collective action problem of who will carry this out). Alternatively, if there is heterogeneity among group members in the costs and benefits of signaling, those who have most to gain from signaling group quality will have greater incentives to pay the costs of signal production and/or enforcement. In any case, groups that can solve collective action problems and motivate members to contribute at high rates will send stronger signals and gain competitive advantages over other groups.

Piggybacking. Allowing individuals to gain additional selfish benefits from contributing to the group-signaling effort will ameliorate any collective action problems that arise. In this case, individuals have clear incentives to contribute to the collective display because they gain individually by signaling their own hidden attributes (as in the case of Meriam turtle hunters discussed above). Allowing individuals to showcase their skills will accomplish this as well; thus it is quite understandable that feasts and other ceremonial events are often accompanied by dancing and other competitive displays or that artisans are motivated to display their skills in such contexts (e.g., carved masks in Northwest Coast Indian ceremonies).

Collective benefits. The greatly expanded scale and "redistributive" nature of much group-level signaling (particularly feasting) has important social implications.

If through collective displays a group demonstrates to its own members that it can overcome any collective action problems associated with signal production, it may be more likely to be able to solve such problems in other arenas, such as warfare and defense, thereby deterring potential competitors. Furthermore, signals in the form of public goods sent by large numbers of cooperating individuals do end up providing large material benefits to recipients. For example, frequent feasts by competing lineages spur production surpluses, which tend to feed more people, a perhaps subsidiary but beneficial outcome. The complex interplay between individual and collective benefits to signaling is discussed further by Smith and Bliege Bird (2000, n.d.) and Gintis et al. (2001).

GENDER AND SIGNALING GAMES

In our previous publications applying signaling theory to the explanation of certain subsistence activities, we have concluded that in most of these cases subsistence-based signaling appears to be a male specialty. In many societies, women's ability to enter these signaling contests is limited by their own opportunity costs and their choices about whether to participate; in others, men impose rules that limit female participation. However, it would be a major mistake to conclude that women do not compete in signaling games. While women (and female animals in general) have been portrayed as relatively passive, selfless mothers, more modern views have tended to show the opposite (Hrdy 1999). Females compete, often directly, with other females not only for access to resources needed to support their families but also for high-quality mates and allies.

Yet there is also no doubt that women often compete very differently from men. One striking example concerns the Mendi, residents of the central Highlands of New Guinea. Both men and women build up networks of exchange partners, *twem* (Lederman 1990). Women's and men's *twem* relationships are similar in form but differ in scope, intensity, and goals. Men tend to have more partners at one time and more exchange debts and credits and to spend more time in exchange-related activities. Women conduct transactions mainly for marriage and funeral feasts sponsored by individuals, an activity that involves giving away smaller portions to more individuals. Men focus on acquiring large amounts of wealth for periodic display in clan-sponsored ceremonies such as warfare compensations that contribute toward their status as "big-men." While some may interpret such differences as evidence of male coercion, others see them as expressing differences between men and women in goals or interests. Exploring such issues may be one of the most significant arenas for future ethnographic application of signaling theory.

MISUNDERSTANDINGS OF COSTLY SIGNALING

Costly-signaling theory has provided a very robust and elegant framework for analyzing the problem of reliable communication when signalers and recipients lack per-

fectly coincident interests. Since partially conflicting interests can be predicted in a large variety of interactions (even including parents and offspring, mates, and allies), the costly-signaling solution is potentially of wide applicability. However, it is easy to interpret the theory in an overly simplistic or misleading fashion.

Cost is not enough. Since virtually all behavior involves some cost, signal cost itself cannot be diagnostic of a costly-signaling dynamic or adaptation. At minimum, a costly-signaling analysis must show that signal cost (or benefit) is quality-dependent as defined above. Even quality-dependent cost does not guarantee honesty; for example, only wealthy suitors can afford diamond engagement rings, but this does not guarantee that such suitors will follow through with marriage, only that they are willing to pay a significant cost to keep that option open.

Signals need not impose handicaps. Despite the terminology utilized by many proponents of costly-signaling theory (e.g., Zahavi and Zahavi 1997), signal cost need not be so great as to impose a “handicap” upon the signaler; in fact, the logic of costly-signaling theory predicts that a signal that would handicap a low-quality signaler may be cheap for a high-quality signaler (Getty 1998). The theory requires that one distinguish between the observable or objective cost of a signal (e.g., the money a suitor spends on an engagement ring, the energy a peacock expends in dragging around a large tail) and the fitness or utility deficit the signal imposes on the signaler. If cost in the latter sense is quality-dependent, then the objective cost (signal intensity) will be a good index of ability to pay and hence of some underlying dimension or quality of interest to recipients.

Costs have different sources. Confusion about signal cost can also arise through failure to distinguish different types of cost. Some signals are intrinsically costly to produce (e.g., stotting, monumental architecture) or to maintain (e.g., a peacock’s tail, familiarity with the latest cinema or musical styles). Other signals are cheap to produce but entail costs through their potential consequences—especially social consequences (e.g., “status badges” in the plumage of certain bird species or boasting about one’s fighting ability in a bar full of rough characters). It is easy to see how the signal production costs fit into the costly-signaling framework; if such costs are quality-dependent (higher-quality individuals pay lower marginal costs), then the conditions for honest signaling are at least partially met. In the second case, when signal production is cheap but has potentially high consequence costs, it becomes somewhat harder to distinguish costly signaling from other means of ensuring honest communication. But the quality-dependence requirement remains the same: if higher-quality individuals face lower consequence costs for a given level of signal intensity, then honest signals of quality may be favored. This sort of dynamic is relevant to the problem of how human linguistic communication can be kept relatively honest: those who exaggerate their abilities or accomplishments (signal a higher quality than they actually possess) will be punished (pay a disproportionate con-

sequence cost) if their exaggerations are discovered (Lachmann, Szamado, and Bergstrom 2001).

Honesty need not be costly. If signaler and recipient have sufficiently coincident interests because of high relatedness or other factors, honest communication can be stable without signal cost (Bergstrom and Lachmann 1998, but cf. Brilot and Johnstone 2003). In addition, anatomical constraints may guarantee accuracy in some cases (Maynard Smith and Harper 1995). For example, in the competitive roaring of red deer stags, larger and heavier deer have lower-frequency roars, and this is an unfakeable (but not costly) signal (Reby and McComb 2003).

Costs can dwindle at equilibrium. Even under a costly-signaling dynamic, cost may be very low or even absent at equilibrium (Lachmann, Szamado, and Bergstrom 2001). For example, suppose that the relevant quality is dichotomous (i.e., there are only two types of signalers, high-quality and low-quality) and the equilibrium is such that only high-quality individuals signal (a standard result in dichotomous-quality signaling models). Such an equilibrium can occur even if signal cost (for high-quality individuals) is zero or negative—that is, even if the signaling behavior is intrinsically beneficial to signalers, not including the benefits obtained when receivers respond (Gintis et al. 2001). This is not as remote a possibility as it might seem. For example, suppose that some individuals are superior foragers and can efficiently pursue and harvest certain prey types that would be very inefficient for low-quality foragers to obtain. In that case, high-quality foragers may benefit both from the foraging returns and from the signal value of harvesting such prey (e.g., they may be preferred as mates because their success in capturing the prey in question serves as a reliable signal of more general foraging abilities). There will be no signaling cost at equilibrium, even though this equilibrium is maintained by cost functions (i.e., the cost of taking these prey would be so high for low-quality foragers that even the addition of receiver benefits would leave them with a net deficit in fitness). A similar result can apply to continuous distributions of quality and signaling intensity if costs are due to signal consequence rather than production (Lachmann, Szamado, and Bergstrom 2001). In both cases, signaling equilibria are stabilized by the costs that nonoptimal behavior would entail (e.g., signaling more intensively than one’s quality would warrant) rather than by the costs of observed (equilibrium) signaling. In an insightful discussion of these various issues, Lachmann et al. (p. 13193) conclude that low- or zero-cost signals—so-called conventional signals—can be expected when signalers and recipients have sufficiently coincident interests or signal claims are independently verifiable. Conversely, costly signals are predicted (1) in one-time interactions, (2) when communicating about otherwise unverifiable properties, or (3) when the expected gains from deception exceed the expected costs from sanctions or punishments imposed by deceived observers.

Signaling frequency may not decline with familiarity. One might expect that once a set of individuals had established differences in quality among its members, sig-

TABLE 3
Applications of Signaling Theory to Ethnographic Examples

Signal Type	Underlying Quality	Benefit to Signaler	Benefit to Recipient	Condition-Dependence
Redistributive feast	Alliance (kin group) size and cohesion	Enhanced political power and marriage-market status	Reliable information on whom to ally oneself with, marry, or defer to	Amount of feast food provided directly dependent on size and industriousness of host group
Big-yam display	Esoteric knowledge, surplus labor for nonproductive work	Increased prestige, political power, mating success	Reliable information on whom to ally oneself with, marry, or defer to	Yam size dependent on skill, knowledge, and labor investment
Hunting difficult prey	Physical vigor, cognitive ability, foraging ability	Deter competitors and attract potential mates	Avoidance of costly competition with better competitor, choice of highest-quality mate	Failure rate and mean return rates dependent upon skill and cognitive ability
Artistic elaboration	Cognitive and motor skills, time available for non-subsistence labor	Attract better mates and allies	Reliable information on whom to marry or ally oneself with	Quality of artistic production directly dependent on skills and/or time investment

naling would cease. More precisely, the more information observers have on signaler quality, the lower the marginal payoff from signaling, and hence the lower the equilibrium amount of signaler investment in signaling we should observe (Neiman 1997, Lachmann, Szamado, and Bergstrom 2001). Yet further thought suggests several reasons that individuals might continue to gain benefits from signaling and observers from attending to signals even if the audience is quite familiar with the signaler. First, when signal meaning is noisy because of variability unrelated to the relevant intrinsic quality of the individual, signalers may need to signal repeatedly in order to ensure that receivers can interpret the signal (Boone 1998). Secondly, repeated signaling is necessary if past and present quality are poorly correlated; for example, signals of health and vigor may be subject to rapid short-term changes (e.g., due to infectious disease), and individuals or coalitions may need to advertise their current economic condition if fortunes rise and fall or membership changes over time (Boone 2000). Finally, when signalers are competing with others in their social group regarding their commitment to delivering collective goods in order to retain political privileges, they may need to continue signaling even if others are quite familiar with the competitors. To cease signaling would in effect signal inability or unwillingness to continue in the role of political patron, thereby yielding the perks of political leadership to competitors. This sort of dynamic may characterize situations ranging from big-man systems to potlatching by rival chiefs to “pork-barrel” politics in representative democracies.

Costly-signaling theory is a complex and subtle framework that applies only to certain situations in which specified conditions hold. To employ it properly, we must carefully consider types and sources of costs, their relation to signaling equilibria versus disequilibria, al-

ternative means of ensuring credibility, and the conditions governing variation in signal meaning over time.

Conclusions and Prospects

Our primary aim in this paper is to examine the potential explanatory value of signaling theory for a variety of anthropological topics. We want to reiterate that application of this theory to human social behavior is at an early stage and judgment of its value must await rigorous empirical evaluation. Our discussion of ethnographic phenomena was designed to illustrate what signaling explanations might have to offer; we did not attempt to subject these explanations to adequate tests—indeed, the requisite evidence to do so is generally lacking (although some exceptions, including Meriam turtle hunting, are discussed above). In addition, even if signaling theory proves as powerful an explanatory framework as we suggest it may, it will elucidate only one aspect of why human behavior and social institutions (even the ones discussed in this paper) take the forms they do.

The available evidence suggests that signaling theory does have considerable promise for generating novel and powerful insights into the ethnographic domain. For a variety of phenomena ranging from subsistence production to feasting to artistic elaboration, the fundamental conditions for honest signaling of condition-dependent qualities appear to be met (table 3). The underlying qualities being signaled range from physical vigor to cognitive skills to coalition size and cohesion. While the precise benefits to signalers and receivers have not been measured in most cases, the leading contenders include obtaining better mates, forming valuable alliances, and avoiding the costs of violent competition.

We have argued here that signaling theory offers a re-

markable opportunity to bridge semiotic and materialist frameworks by integrating an interactive theory of symbolic communication and social benefit with materialist theories of individual strategic action and adaptation. One of the classic lessons of anthropology has been that economic activity is not just about making a living but about communicating values and expressing meaning. This insight formalizes what many different scholars (beginning with Veblen) have realized: signaling theory offers a deep understanding of why material goods and the time and resource costs they represent are such good media for communication. As Rappaport (1979:181) has written,

When a Goodenough Islander (Young 1971) or a Siuai (Oliver 1955) transmits the message that he is a man of importance, influence, or prestige by giving away large numbers of yams and substantial numbers of pigs he is not simply claiming to be a big man. He is *displaying* the *fact* that he is. The amount that he gives away is an index of his "bigness" because it is "really affected by" that which it signifies—his influence, prestige, authority . . .

But signaling theory also proposes that communication is aimed at securing social benefits with real material consequences and that these consequences are crucial to an understanding of the form, dynamics, and fate of communicative and symbolic behavior. This proposition is thus far mostly untested, but the opportunities for testing and refining signaling-based explanations in ethnographic contexts are rich. We hope that the sketch we have provided will generate further interest and substantive research.

Comments

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One has to be encouraged by an idea that can incorporate the thoughts of Bourdieu, Veblen, and Darwin into a theoretical foundation that has promise for explaining both peacock tails and potlatches. To appreciate the contribution of the ideas presented by Bliege Bird and Smith one has to be attentive to the fact that signaling theory was developed, in part, to help understand how honest communication between organisms could evolve (Dawkins and Krebs 1978). Signaling theory is a theory of communication, and in the context of humans it is fundamentally a theory of culture. As a practitioner of behavioral ecology, I have had nagging misgivings about its apparent lack of tools for adequately incorporating culture into its purview (Alvard 2003). I am encouraged of late, however. Bliege Bird and Smith correctly tell us that signaling theory has the power to explain, within

the larger umbrella of evolutionary theory, much symbolic and ritual behavior that has otherwise been put down by many anthropologists to the capriciousness of culture. It therefore has the potential to provide the theoretical tools for linking traditional cultural anthropology, behavioral ecology, and evolutionary approaches to culture.

One advantage of cultural learning is that it provides benefits in contexts in which individual learning is error-prone or costly in time and/or effort (Boyd and Richerson 1995). A forager deciding whether to hunt or fish may find it best in some situations simply to copy his neighbor's strategy rather than spend time and effort in costly trial-and-error learning. Cultural organisms can engage in individual learning if costs are low and success likely; otherwise, they can imitate others. This process parallels an important aspect of signaling as presented in the target article: "costly-signaling theory involves the communication of attributes that are relatively difficult or expensive to perceive directly." It seems to me that one way to look at signaling is as essentially a cultural process in which the hidden attributes are social ones.

A useful way to think about signaling and culture together is in terms of the economic concept of transaction cost. For example, finding a suitable spouse involves time and effort, especially if it is difficult to discern the qualities of the various choices. In addition, it is difficult to learn from direct personal experience because choosing a mate occurs too infrequently during one person's lifetime to produce a sufficiently large sample (Thaler 1992). The time and effort spent in acquiring adequate information to make an informed choice are transaction costs that can be mediated by attention to signals that correlate with the signaler's quality of interest. One could interpret Bliege Bird and Smith as arguing that signals allow social partners to reduce the transaction costs of political, sexual, or economic exchange.

Exchange is the most basic form of cooperation, and, in fact, signaling theory rests on the assumption that there are mutual benefits to be gained from truthful communication. In these mutualistic contests, signals allow people to solve what game theoreticians call coordination or assurance games (Binmore 1994). One can conceive of coordination as an exchange in which it pays for players to cooperate (i.e., there are mutual benefits to be gained, in contrast to a prisoner's dilemma, in which it always pays to defect). The key for the participants in such an exchange is to increase the likelihood, or assurance, that their partners will "play by the same rules" (i.e., follow the same postmarriage residence rules, drive on the same side of the road, butcher and distribute prey in the same way [Alvard and Nolin 2002]).

But how do we know whom to trust? With whom do we share these arbitrary details of social life? These questions concern identifying attributes of others that are relatively difficult or expensive to perceive directly. Among other advantages, the cultural mechanisms involved in signaling provide people the ability to infer each other's mental states, to assort preferentially with others who have similar (or complementary) intentions

or capabilities, and to reap the advantages of coordinated activities (Tomasello 1999). It is to the understanding of this process that signaling theory has the opportunity to make its greatest contribution.

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This lucid and ambitious paper persuasively argues that signaling theory enables us to understand disparate phenomena in which individuals or groups make great efforts to provide information to others about underlying attributes that are difficult or impossible to observe directly. The authors carefully specify the conditions under which such costly signaling is likely to occur. They have convinced me that a signaling framework helps explain certain otherwise puzzling aspects of human behavior.

The paper could have been more explicit about the extent to which the emitters and interpreters of costly signals understand their actions. Such signals have often been analyzed from the perspective of semiotics (e.g., Peirce 1932–58, Sebeok 2001); the assumption here is that senders and receivers know what is being communicated. The authors, however, do not emphasize the presupposed cultural knowledge entailed in signaling. Their focus instead is on functional analyses in which signaling is seen as a way for individuals and groups to acquire prestige, power, and mates. Relatively little attention is given to the cultural evolution of signaling. The authors tentatively say that “design forces” such as decision making, subconscious learning, natural selection, and adaptive cultural transmission should favor “a system of communication conforming to the costly-signaling framework.” This formulation leaves open the question whether the users of such systems of communication are aware of their alleged functions.

As Bliege Bird and Smith acknowledge, many of their “signaling” explanations of particular cultural phenomena are not new. They derive inspiration from the work of Veblen and Bourdieu on conspicuous consumption and symbolic capital and cite diverse other writers taking a signaling approach to topics such as the potlatch, monumental architecture, and Melanesian feasts. One could add related (although perhaps less directly relevant) analyses of multivalent ritual symbols (Turner 1967) and hierarchies of responses to environmental perturbations (Vayda and McCay 1975). Nonetheless, a number of their signaling-oriented explanations are new to me. Some are convincing (e.g., those concerning seemingly wasteful subsistence activities); others (e.g., those related to artistic elaboration) seem less compelling.

The underlying assumptions of this paper are clearly those of evolutionary ecology. In case after case, the function of costly signaling is said to be “enhanced social status and its subsequent political and reproductive advantages.” What marks this as evolutionary ecology is of course the emphasis on “reproductive advantages.”

The evidence that costly signalers have greater “reproductive success” than others is not presented in any detail. I would think that desires for increased social status (often including the acquisition of prestigious mates) and power would be sufficient motives for costly signaling among humans even if reproductive success is relevant to analogous phenomena among other species.

Perhaps the paper’s most debatable assertion is that “signaling theory allows us to address issues of symbolic value with rigorous empirical data and a set of testable predictions derived from a body of theory that is linked to individual strategizing and evolutionary dynamics.” Little supporting evidence is presented for this bold statement. The paper includes assertions such as “More rigorous formulation of signaling arguments and empirical tests thereof are needed,” “As in other domains, much further research is needed to subject these plausible scenarios to rigorous empirical test,” “Application of this theory to human social behavior is at an early stage and judgment of its value must await empirical evaluation,” and “The precise benefits to signalers and receivers have not been measured in most cases.” One of the major critiques of functionalist explanations is their nonfalsifiability; I see no reason to think that the explanations of signals offered here are any different.

A notable feature of this paper is its reexamination of conventional explanations for food sharing among foragers. Most anthropologists explain such generosity (often “unconditional”) with respect to uncertain returns to subsistence activities. From this perspective, food sharing is a risk-reducing activity that enables members of foraging groups to be fed even on days on which their subsistence efforts are unsuccessful. Food sharing also helps those who are ill or are working on non-subsistence-related tasks. Bliege Bird and Smith suggest that risk minimization is “a welcome but unanticipated outcome of rather than a motive for food sharing.” They emphasize instead the social benefits that accrue to those who signal their survival skills by being able to share some of the meat and plant foods they obtain. These two explanations of food sharing do not strike me as contradictory; both may help explain unconditional generosity among foragers.

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Human behavioral ecologists have been promoting signaling theory for the study of cultural phenomena for nearly two decades (e.g., Harpending, Draper, and Rogers 1987; Kaplan 1987; Cronk 1991, 1994a, b, 1995, 1999, 2001, n.d.; Irons 1996). Bliege Bird and Smith report progress on this front, identify some parallels with other approaches, and provide ethnographic examples that costly-signaling theory can elucidate. I am already on record as sharing their general position and will limit my comment to a few points.

Bliege Bird and Smith identify parallels between costly-signaling theory and the insights of Veblen, Mauss, and Bourdieu. While these theorists are likely to be familiar to cultural anthropologists, other social scientists have independently developed similar ideas. Schelling (1960) provided insights about signals of commitment, Spence (1973) developed a model of job-market signaling, Frank (1988) applied the same logic to signals of moral commitment, and political scientists (e.g., Baumgartner and Leech 1998, Kollman 1998) have made similar arguments about the lobbying efforts of interest groups. Even Theodore Geisel, better known as Dr. Seuss (1961), explored indexical signals (Maynard Smith and Harper (2003) and the circumstances in which they might be undermined by innovation.

Costly signals' ubiquity and prominence make them an appropriate choice for an article of this kind. However, as Bliege Bird and Smith point out, signaling theory also offers other insights. Among the most promising is the examination of the role of receiver psychology in signal design (Guilford and Dawkins 1991, Rowe 1999). Bliege Bird and Smith refer to this briefly in their discussion of sensory exploitation, suggesting that a consideration of this factor might shed light on such phenomena as advertising, propaganda, and pornography. Other examples already in the literature of signals with design features that reflect the importance of receiver psychology include "motherese" (Fernald 1992), kin terms in political rhetoric (Salmon 1998), kin terms and mating competition (Chagnon 1988, 2000), derogation of same-sex mating competitors (Buss and Dedden 1990), features of religious concepts (Boyer 1999) and rituals (Sosis and Alcorta 2003:265), symmetry in ceramic designs (Washburn 1999), and neoteny in toy design (Hinde and Barden 1985).

Signaling theory's breadth has implications for the way it is best approached by anthropologists. Bliege Bird and Smith's method of first identifying behaviors that are remarkable for their costliness is representative of much of the existing literature. This approach is vulnerable to the criticism that it stacks the deck in favor of costly-signaling theory. An alternative is to identify a signal without regard to its apparent costliness and then explore a variety of explanations, including but not limited to costly-signaling theory, for its design features. For example, some colleagues and I chose to study cosmetics not because of their costs but because of their popularity, their importance in the lives of many people, and their relevance to the study of facial attractiveness. While women may spend a great deal of time and money on cosmetics, such costs are not related to their underlying qualities in the way predicted by costly-signaling theory. Our preliminary findings indicate that receiver psychology is more important than cost in understanding cosmetics use, with women using them primarily to make their faces more noticeable and memorable (Cronk et al. 2002, Milroy et al. 2002, Wigington et al. 2004).

As Bliege Bird and Smith explain, the common and conflicting interests of signalers and receivers are keys to understanding signal design. In evolutionary terms, a

conflict of interests exists between two parties when selection would favor a different outcome for their interaction if it were determined solely by selection on genes in one party or the other (Maynard Smith 1991, Trivers 1974). Two parties have common interests when selection acting on genes in both of them would favor the same outcome from their interaction. Bliege Bird and Smith state that costly signaling is favored when signalers and receivers have "partially competing interests." It is possible to describe this situation more precisely. Specifically, costly-signaling theory is relevant where there are confluences of interest between individual signalers and individual receivers in contexts where the broader categories to which signalers and receivers belong have conflicting interests. For example, predators and prey *as categories* have conflicting interests, but *individual* predators and *individual* prey, like the ungulates mentioned by Bliege Bird and Smith, experience a confluence of interests if the prey are truly capable of making a pursuit not worth the predator's bother. The conflict of interest in that case is not between the alert, physically fit individual of the prey species and the predator but rather between different members of the prey species. Similar reasoning can be applied to other situations where costly and indexical signals are common, such as courtship displays.

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Bliege Bird and Smith offer us a clear and well-structured article that highlights potential applications of signaling theory for the study of human behavior and culture. This theory stems from biology's interest in the role that information plays in the evolution and functioning of biological systems. In particular, it owes much to the work of Amotz Zahavi, an Israeli evolutionary biologist who has sought to explain the evolution of structures and behaviors that appear to endanger organisms and, thus, to decrease their fitness. As is the case in sociobiology and related fields of inquiry (e.g., evolutionary psychology and behavioral ecology), sexual selection as a sign of fitness and cost/benefit estimates are key to signaling theory.

The theory, in addition, favors visible behaviors in which sender(s) and receiver(s) of information interact and in the process appraise each other and gain some benefit. Moreover, it assumes that cost helps ensure the reliability of the signal (Zahavi 1979, 1993). This is problematic when it comes to humans because they engage in a variety of concealed and ambiguous actions that are often costly. Bliege Bird and Smith, to their credit, attempt to present a nuanced argument and concede that this exposes one of the theory's limitations, specifically, its inability to account for costly unconditional acts of generosity that are secret or anonymous.

However, it seems to me that Bliege Bird and Smith

must scrutinize further the cost-reliability component of the theory, since the ethnographic record reveals many instances in which humans invest a great deal in the creation and propagation of unreliable and ambiguous signals. This is particularly the case in the realm of politics, where bluffing and deception are rather common (Bailey 1988). In fact, among the members of any human society one will commonly find multiple and conflicting versions of what constitutes appropriate action, with the ambiguity thus generated often leading to change and innovation. If signaling theory is to have the broad applications that Bliege Bird and Smith hope for, it must account for both behavioral and cultural continuity and change and do so without promoting reductionisms that do violence to the gamut of human possibilities. For instance, they suggest that stylistic traditions in art may facilitate within-group comparisons. Though this may be the case in some instances, stylistic traditions may also persist because it is the process of re-creating/copying traditional motifs (including the psychological states associated with it) that is valued rather than the final product that may enter the realm of invidious comparison.

Advocates of signaling theory should also explore the fact that humans generate a plethora of costly nonutilitarian signals, often creating (materially and symbolically) and embellishing more than is necessary. This is clearly seen in the evolution of various graphic arts, where earlier naturalistic forms through time become more elaborate and stylized to the point that their meaning is accessible to a select few. Though the drawing of social boundaries frequently underlies such developments, I contend that there is more to this, since social lines can be drawn via less elaborate and costly means. It seems that the human mind generates a multitude of signals to satisfy itself and in the process generates “waste.” While Bliege Bird and Smith will turn waste into nonwaste and explain the expenditures involved by appealing to the “manipulation of social relations” and “status building” (and their ultimate reproductive benefits), I suggest that it may be a by-product of the human mind that may serve no purpose at all. Moreover, waste—even if costly—can be fun; the mind can derive pleasure from wasteful acts (signaling in this case) that are costly because the mind also “plays.” While some may argue that it actually needs to play, I will go farther and claim that it does so even when there is no apparent need as such.

Lest I be misunderstood, let me emphasize that I do not consider status and manipulation of social relations unimportant. To me they are part of a much larger story about the nature of human beings. For instance, unconditional sharing while trekking can promote bonding and a feeling of security among members of an Aché trekking party, all of whom may face potential dangers (e.g., hostile encounters with Paraguayan nationals and physical injuries). The selective incentive may not be social status (with its additional political and reproductive gains) but the survival of the group regardless of individual personal status. Indeed, the fact that not all humans are equally motivated to reproduce and that a significant portion of

our lives is not directly concerned with mate selection for the purpose of reproduction should encourage us to ask if signaling theory places inordinate emphasis on sexual selection. I hope that scholars of gender and abstemious religious communities will join this interesting discussion.

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The essence of signaling theory, as Bliege Bird and Smith explain, is what is variously termed private, incomplete, or asymmetrical information—some participants in a social interaction have difficult-to-observe qualities that are critical to the decision making of other participants. Bliege Bird and Smith insightfully apply signaling theory to phenomena frequently observed in nonmarket economies. This theory has also been widely applied to phenomena in market economies. One of the first and most influential of such papers was a formal model of the role of education in the job market (Spence 1973) that was essentially identical to biologists’ arguments about the role of the peacock’s tail in the mating market (see Bowles and Hammerstein 2003). The productivity of job applicants is a difficult-to-observe quality. Education does not necessarily improve job applicants’ productivity (learning Latin has little application to business), but if the time cost of education is negatively correlated with productivity (because, for example, high-productivity individuals learn more quickly), then achieved education level is an honest indicator of productivity and individuals with more education will be hired at higher wages. Signaling theory has also been applied to high borrowing rates on local Third World markets, discrimination against minorities in labor markets, unemployment, credit rationing, and bargaining. The work of Spence and others in the 1970s laid the foundation for a general theory of the role of asymmetric information in markets, recently earning them Nobel Prizes in economics.

We agree with Bliege Bird and Smith that signaling theory is likely to be broadly useful in the social sciences. It has been argued, for example, that honest signaling may play an important role in powerful psychological states such as depression and suicide (e.g., Hagen 2002, 2003; Watson and Andrews 2002). Hagen and Bryant (2003) argue that group displays of music and dance and other forms of elaborate cultural production may be credible signals of coalition quality because they require the long-term association of the participants as well as the surplus production necessary to support the cultural producers. This approach may illuminate two features of human socioecology that distinguish it from that of other primates. First, reliable signals of coalition quality permit the evolution of group-level alliances resulting in uniquely human regionwide social structures (in contrast, the segmentary lineage system of hamadryas baboons requires consanguineal ties [Rodseth et al. 1991]).

Second, these signals entail cultural transmission. Given that song learning in birds is one of the few clear cases of cultural transmission in nonhuman animals and that singing is common in apes (i.e., gibbons and siamangs), coalition signaling may be important to the evolution of human cultural transmission as, for example, a preadaptation for other forms of culture.

Although we find many of Bliege Bird and Smith's examples compelling, we are less convinced that signaling theory adequately explains the frequent and widespread food sharing commonly found in small-scale societies. They cogently argue that because individual quality can change over time, signals of quality must be repeatedly sent. But do they have to be sent almost every day? As Bliege Bird and Smith note, the number of models of food sharing is surprisingly small. Because we believe that consideration of a broader range of models would be useful, we outline one that has been relatively ignored by evolutionary ecologists. Corporate groups, including hunter-gatherer bands and lineages, typically defend a territory, and this defense entails political and military costs that are distributed across group members. Corporate group members pay these costs because the territory is valuable to them and they therefore consider themselves its "owners." A corporate group that "owns" a territory also "owns" whatever valuables that territory contains. If the value of the territory is that it has wild game, then—and here is our main point—that game is "owned" by the group and not by the particular hunter who kills the game. Hunters are "employees" of the corporate group, and their production (hunted game) belongs to the corporation and must be distributed among its members. Among the Ache, for example, meat is widely distributed and hunters very rarely eat from their own kills (Hill and Hurtado 1996: 65). Hunters are then "paid" in a variety of "wages" that are culturally specific and (in contrast to Ache practice) may include rights to distribute the meat, to receive choice parts of it, or to consume some fraction of the kill prior to distribution and, as Bliege Bird and Smith suggest, increased status with all its perks.

We have merely sketched this group-ownership model of food sharing, and it confronts the many challenges typically associated with larger-scale collective actions, including free riding, division of labor, management, and distribution of benefits. Despite this one point of partial disagreement, we consider Bliege Bird and Smith's article a powerful and welcome blow to the wall that has divided materialist and symbolic theories in the social sciences.

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Models of costly signaling are among the most exciting developments in evolutionary theory in the past several decades. Bliege Bird and Smith brilliantly highlight their revolutionary relevance for anthropology and archaeology. Archaeologists have long relied on monumental

architecture, fancy portable artifacts, and, most recently, evidence of feasting to construct narratives about social complexity and power (e.g., Dietler and Hayden 2001, Trigger 1990), but they have lacked a theoretical account of the causal dynamics that link extravagant artifacts to the social and cultural dynamics that are alleged to account for them. As Bliege Bird and Smith show, signaling theory offers this missing link and thereby promises to convert what has been a largely free-form interpretive enterprise into a model-based analytical one. I hope to advance their project by sketching the potential of signaling theory in historical archaeology.

Over 30 years ago James Deetz recognized, in the archaeological record of seventeenth- and eighteenth-century British North America, important changes in the consumption of objects at a variety of scales from dining paraphernalia to houses. He interpreted these changes as symptoms of a cognitive shift from a medieval to a Georgian mind-set typified by a novel emphasis on the separateness of the individual and the orderly partitioning of daily life (1972, 1977). Since then social and economic historians, using additional evidence from tax records, probate inventories, and merchant accounts, have recognized an increase in the salience of fashion and the rate of consumption across the Atlantic world after 1600. They have dubbed the trend "the consumer revolution" (e.g., Carson 2003). Their work offers independent evidence for the idea that much of what archaeologists think of as "Georgian" is actually an increase in the amount of effort devoted to social display by individuals at all wealth levels (Carson 1994, de Vries 1993, Pogue 2001).

The period witnessed a dramatic increase in the frequency of imported, refined ceramic vessels. Some vessel forms were associated with the consumption of exotic and costly beverages such as punch, tea, and coffee. Other forms—mugs, cups, and later plates—replaced functional equivalents that had traditionally been made in wood and pewter (Smart 1989, 1994). Increasingly vessels came in matching sets. These changes are linked because they represent increases in the costs paid by ceramics consumers. Tea, coffee, and punch required not only exotic and costly ingredients but also resource outlays for novel vessel forms. Replacing traditional pewter vessels with ceramic ones involved additional costs because ceramics had shorter use lives and old pewter could be profitably recycled (Neiman, McFaden, and Wheeler 2000). Finally, the emphasis on matched sets meant that purchase costs could not be amortized over a long period.

A similar case can be made for architectural change. For example, the central passages that typified what Deetz called the "Georgian" house plan were far larger than the lobby entries that they replaced in New England, offering more scope for costly display in the first room visitors entered. Increasingly, the stylistic details of the most prestigious displays were drawn from classical Roman and, later, Greek sources (Sweeney 1994). Consumers bore the increased labor costs required for their correct production. They also had to acquire the knowledge to discriminate correct from incorrect from

the study of expensive folios. Novel symmetrical facades attested to their builders' ability to build an entire structure at once.

Signaling theory points to three factors that are likely to account for these changes: (1) the increase in geographical mobility that accompanied European colonial expansion, bringing together strangers who relied on signals in assessing one another's competitive abilities (Carson 1994); (2) the increasing proportions of the population whose livings were made in nonagricultural niches in which the determinants of economic and social success were not available for public inspection, as a farmer's fields were; and (3) the resulting increased rates of social mobility, both up and down, which placed a premium on signals engineered to be up-to-date indicators of signalers' qualities.

Signaling theory promises interpretations of cultural dynamics that span oceans and centuries and helped create our modern world, but so did the Georgian mind-set and its teleological, neo-Marxist cousin the Georgian order of merchant capitalism (Leone 1988). Why should we be more sanguine about the long-term credibility of accounts based in signaling theory? First, the link between artifacts and their meaning is causal, not symbolic. Signaling models are explicit enough to deliver detailed predictions about the design and distribution of variation relative to historically specific social and environmental contexts (e.g., Neiman 1997). Moreover, as Bliege Bird and Smith show, they provide the best accounts we have of signaling in the historical trajectories of human and nonhuman species. The diversity of successful applications would be unlikely if signaling theory did not capture an important process in the history of all living things.

Many of the theoretical notions that have dominated historical—and much prehistoric—archaeology inevitably produce one-off results that are of marginal usefulness to colleagues studying other times and places, despite their individual brilliance. In contrast, signaling theory will allow archaeologists to build and evaluate models of the historical dynamics that gave us Chacoan great houses, Chesapeake mansions, and Mayan stelae. Signaling models may mitigate the balkanization that characterizes our postmodern professional lives.

Reply

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We thank the commentators for their thoughtful and well-reasoned replies. We are particularly grateful to Cronk and to Hagen and Hammerstein for drawing attention to the development of signaling theory in economics, which we gave short shrift in the interest of more ethnographic details. Cronk is quite correct in pointing out that an approach which focuses on only

obviously costly signals “stacks the deck” in any analysis. Our point in this paper was not to evaluate alternative explanations for the design of signals but simply to show how costly-signaling theory in particular can provide adaptive explanations for apparently “wasteful” traits or behaviors. We did take pains to note that questions about the function and evolution of design features in any particular signal should consider a variety of explanations and design forces, including receiver psychology.

As Chibnik points out, our notion of “design forces” shaping adaptations (including signaling strategies) is agnostic on the question of whether actors (signalers and receivers) are consciously pursuing strategic goals. We think that the fact that the costly-signaling framework applies to both intended and unintended aspects of communication and strategic interaction is a strength, not a flaw. But there are some tricky issues raised by functionalist analyses. Following Elster (1983), we define a functionalist explanation as one in which some action or institution A is explained by its beneficial consequences B. The immediate problem is that a consequence (B) is used to explain the action (A) that produces it. This seeming paradox can be resolved if there is a causal feedback loop such that the presence of B increases the production of A (Elster 1983). Prominent candidates for such a feedback loop include learning (positive reinforcement and its variants) and natural selection, which also appear on our list of adaptive design forces. The poor reputation of functionalist analysis comes from the fact that many analyses fail to suggest any feedback loop linking consequence and action, thus leaving the causal connection mysterious. When the hypothesized benefits are not ones that would be favored by either natural selection (on genes or culture) or rational choice, the mysterious becomes dubious (Smith and Winterhalder 1992b:42). However, the signaling explanations reviewed in our article avoid both of these problems. They also are exempt from the problem of “nonfalsifiability” raised by Chibnik, as indicated by the empirical studies we review.

Giordani states that signaling theory stems primarily from “biology’s interest” in communication and, more specifically, from the work of Amotz Zahavi. Because Zahavian “handicap theory” was developed to explain how seemingly costly and maladaptive male ornamentation could actually benefit male reproductive success, she suggests that signaling theory “places inordinate emphasis on sexual selection” and, by association, reproduction. As we (and nearly all commentators) point out, signaling theory owes as much to economics, decision theory, and social theory as it does to evolutionary biology. Sexual selection is not an inherent component of all signaling contexts, and, as we point out numerous times, signaling is not just about males attempting to impress potential mating partners with honest signals of hidden genetic quality. Rather, signaling games can involve women signaling the ability to invest time and effort in the cooking of elaborate feasting dishes as part of a collective signal of lineage quality or men sending honest signals of coalition commitment to political sup-

porters. Such signals are not necessarily designed to acquire immediate reproductive advantages but do function as a way to acquire social, symbolic, or material benefits. These benefits may translate into competitive advantages in acquiring strong marriage alliances or a high-quality partner, in reducing infant mortality, or in achieving access to resources during periods of scarcity—all of which could have reproductive benefits.

Giordani's skepticism about the value of using reproductive consequences as a currency for measuring strategic outcomes is shared by many social scientists. If desire for increased power and social status is enough to motivate signaling strategies (Chibnik), why bother with reproductive advantages? The problem here is the failure to distinguish between proximate and ultimate (evolutionary) causality (Mayr 1965). Within limits, people prefer more status or power to less, wealth to poverty, and so on. The only nonteleological and nonmystical explanation for these preferences (and the innate and learned cognitive processes which underlie them) is the theory of natural selection. Natural selection favors cognitive mechanisms that motivate strategic behavior correlated with reproductive success, whether or not this is something the actors are consciously aware of. Standard causal explanation of human behavior focuses on the workings of these innate, learned, and/or conscious choices, which collectively constitute proximate mechanisms; ultimate or evolutionary analysis focuses on why these mechanisms exist and are designed the way they are. These two modes of causal analysis are complementary, one essentially addressing how questions and the other why (Mayr 1965), and each is a valid framework for analysis of human behavior. However, evolution has endowed humans with unique proximate mechanisms: capabilities for cultural transmission of beliefs and preferences and for the construction of symbolic worlds. In principle, these cognitive or cultural evolutionary processes may decouple choices from adaptive design (Boyd and Richerson 1985), but the extent to which this is the case is an empirical issue that must be decided by careful tests of evolutionary hypotheses (Smith and Winterhalder 1992b).

Giordani suggests that the prevalence of bluffing, ambiguity, and deception in human communication is problematic for signaling theory. Indeed, signaling theory is designed to explain why and under what conditions honest communication might be in both parties' interest—it does not predict that communication must always be honest. If the fundamental conditions for costly or honest signaling are not met, we should expect to see a great deal of lying, deceit, and misdirection. It is worth pointing out here that signaling theory does not preclude other theories of communication, nor does it explain all contextually patterned signals. However, any theory of communication must explain why a high frequency of dishonesty would not destabilize the communication system altogether by motivating observers to ignore signals. Giordani does not offer any suggestions in this regard.

Chibnik proposes that risk-reduction explanations of

unconditional food sharing are complementary to signaling explanations, whereas Hagen and Hammerstein are skeptical of the latter. First, we should stress that we never proposed that all instances of generalized food sharing can be explained by a single model, costly signaling or any other. Second, our problem with risk-reduction explanations is not that they contradict signaling ones (as Chibnik portrays our view) but that the existing evidence does not consistently demonstrate the kinds of safeguards against free riding that would be required to make such a system stable. But (as we also noted) costly signaling is only one possible model to explain how unconditional generosity could be evolutionarily stable, and we welcome testable alternative explanations. Hagen and Hammerstein propose a "corporate-ownership" account that views food shares as the earnings of members of the corporate group (in this case, a residential band or a lineage) that owns the territory from which the food is harvested. Although we would not dismiss this alternative out of hand, we have some significant reservations. Two are empirical: most small-scale societies lack the corporate structure or decision-making processes that could allocate shares in the manner envisaged by Hagen and Hammerstein, and many (particularly hunter-gatherer band societies such as the Ache, whose generalized food sharing is so prominent) are nonterritorial. Finally, there are serious collective-action problems raised by the corporate-ownership account (as Hagen and Hammerstein acknowledge).

As if anticipating Chibnik's skepticism about the role of signaling theory in artistic traditions, Neiman provides a very nice illustration of how it can account for stylistic changes in colonial American vessel forms and architecture. In this case, rather than competition among the artisans themselves to produce finer products (as we suggested), it is competition among consumers to display wealth and good taste that drives the production of increasingly expensive and high-quality items. This neatly shows how costly-signaling theory can be used to explain both conformity and change.

In closing, we want to reiterate that application of signaling theory to anthropological phenomena is at a very early stage. This is why we used such cautious and prospective language in our article when describing this area of research. Chibnik seizes on these statements to question our assertion that "signaling theory allows us to address issues of symbolic value with rigorous empirical data and testable predictions" derived from evolutionary and strategic-actor theory. Yet, as is exemplified by a number of studies discussed in our article (and others cited by Cronk, Hagen and Hammerstein, and Neiman), signaling theory has clearly begun to deliver on these promises. In any case, our primary goal was to explain the promise of signaling theory clearly enough to motivate other researchers to conduct research on patterns of human social behavior that have otherwise remained mysterious or resistant to convincing explanation. We judge the responses of most commentators (including Chibnik) as indicating that our goal may well be attained.

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