Costly Signaling in Human Culture

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Social scientists have long sought to explain seemingly inefficient and maladaptive aspects of human behavior. Across the world's cultures, people give away food without expectation of reciprocity, engage in nonoptimal foraging activities, spend time and energy enduring dangerous and painful religious rites, and add functionless ornamentation to material objects and architecture. These behaviors are especially perplexing to evolutionary scientists, who assume that selection processes result in phenotypes that maximize somatic and reproductive effort. Rather than viewing such behaviors as maladaptive, however, evolutionary anthropologists and archaeologists interpret the wastefulness of these behaviors as enabling reliable and honest communication between individuals with at least partially conflicting interests.

Originating with the insights of evolutionary biologist Amotz Zahavi (1975), costly signaling theory (CST) was first used to interpret many of the extravagant behavioral displays and excessive ornamentation found throughout the animal kingdom, such as male red deer roaring, meral-spread displays of stomatopods, and large antlers among males of many species.

For example, upon spotting a predator (most commonly African wild dogs), Thomson's gazelles (*Eudorcas thomsonii*) leap straight up in the air with their backs arched rather than immediately running away. This conspicuous jumping behavior, known as "stotting," appears to be detrimental to a gazelle's survival since it likely captures the predator's attention and requires an expenditure of energy that cannot be used for fleeing. Individual gazelles range in their fitness and their ability to escape predators, and healthy gazelles would do better to not have to bother to flee. Conversely, predators would do better to not have to expend energy chasing a healthy gazelle, when chasing a less fit gazelle would offer a greater net energetic return. Consequently, it is in healthy gazelles' interests to stot, and predators' interests to pay attention to the stotting behavior of gazelles. Both predator and prey benefit from successful communication.

Zahavi's insight was that costly displays often are not wasteful but, rather, that they enable reliable and honest communication. Fundamentally then, CST is a framework for understanding communication between individuals with partially conflicting interests under conditions where there is a mutual benefit to the reliable communication of the nature of these individual differences (Bliege Bird and Smith 2005).

It is often in an individual's self-interest to send a dishonest signal about some trait (e.g., "I am bigger, stronger, or healthier than I really am"). Zahavi (1975) argued, however, that reliable communication can evolve if signal production is correlated with

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an underlying trait and the costs of producing such signals are prohibitive to those not possessing the trait. In the case of Thomson's gazelles, the underlying trait that is communicated through stotting is the individual gazelle's health and physical fitness, and unfit gazelles are unable to stot, or unable to stot with the same vigor, as healthy gazelles.

Bliege Bird and Smith (2005) formally outline four conditions for the evolutionary stability of a costly signal. First, individuals in a population must vary in some underlying trait that is difficult for other members of the population to observe but that can be reliably signaled. Second, observers of these signals benefit from the information contained in a signal. Third, those who send signals and those who observe them have conflicting interests, so that deception would benefit the signaler at the expense of the recipient. And fourth, signal cost or benefit is dependent on the quality of the signaler.

Anthropologists and archaeologists have employed CST to interpret and explain a wide range of human behaviors including public generosity, inefficient food acquisition, expensive religious displays, monumental architecture, and artistic elaboration.

Public generosity

Selection favors phenotypic traits that confer relative advantages over conspecifics. Therefore, acts of altruism that provide benefits to unrelated others at an expense to oneself ought to be incredibly rare. Humans, however, often give away valuable resources without expectation of reciprocity. Researchers have interpreted some of these instances of generosity as costly signals designed to communicate important attributes of the altruist, who in turn benefits from this communication (Smith and Bliege Bird 2000).

Members of many human groups acquire food cooperatively because, it is assumed, cooperation results in higher net returns than solitary foraging. However, fieldwork conducted by Bliege Bird and colleagues (2012) among the Martu suggests that, in terms of caloric gains, poor hunters benefit from cooperative hunting while good hunters, because of normative food-sharing patterns, suffer. Specifically, all Martu hunters, regardless of skill and contribution, consume the same amount of meat. Thus, cooperative hunting may impose a cost on good hunters. Bliege Bird and colleagues posit that good hunters might benefit from increased reputation and social capital. Indeed, they demonstrate that Martu hunters gain prestige through their generosity, which in turn increases their social network size and access to social resources.

Many ethnographic accounts describe how unconditional food transfers bring a return of status and reproductive benefits. Other forms of public generosity that might conform to the requirements of a costly signal range from contributions to redistribution feasting (such as the potlatch among the Kwakiutl of North America) to blood donations in contemporary Western societies. Although many social scientists have suggested that humans communicate their prestige and status through extravagance, CST offers a way to formally model and test how costly behaviors can emerge and stabilize within populations (Bliege Bird and Smith 2005).

Nonoptimal food acquisition

Processes of natural selection result in phenotypes that adaptively harvest energy and efficiently convert that energy into reproduction. It is therefore puzzling that human foragers often expend energy acquiring food with lower net returns than viable alternatives. Rather than seeing this as inefficient, however, several researchers have employed CST to suggest that nonoptimal food production can sometimes provide material and ultimately reproductive benefits.

For example, turtle hunting among the Meriam, a fishing and horticultural people residing on Mer (Torres Strait, Australia), may function as an honest signal of a hunter's strength, skill, and leadership (Smith and Bliege Bird 2000). As part of large funerary rituals and feasting events, Meriam men team up in groups of three to six to hunt green turtles (*Chelonia mydas*) about sixteen to twenty kilometers from Mer. Hunting groups are composed of leaders who organize and oversee the hunt, jumpers who dive from the boat and capture the turtles, harpooners, and drivers who pilot the boat. When a hunt leader spots a turtle, he directs the driver to follow the turtle. When the turtle tires, jumpers dive into the water to secure the turtle, and everyone hoists the turtle into the boat. Upon returning to Mer, the hunting team delivers the turtles to the family that commissioned the hunt. Members of that family then prepare the turtle for consumption at a public feast.

The costs of turtle hunting include time, energy, and material resources. Moreover, hunting is dangerous and members of the hunt do not get paid for their services, nor do they get compensated with a larger share of food than nonhunters during subsequent feasting. Smith and Bliege Bird (2000) suggest that the costs associated with turtle hunting ensure that hunters are able to honestly communicate individual variance in strength, skill, and leadership to a wide audience at public feasting events. Receivers of these messages gain from reliable information about potential mates and allies, and successful hunters benefit from prestige, have an earlier onset of reproduction, have higher age-specific reproductive success, and have more mates. In other words, the costs associated with turtle hunting result in net status benefits that are translated into reproductive success (Smith, Bliege Bird, and Bird 2003).

Meriam men also seem to fail to maximize return rates when foraging and/or fishing in the sea. In terms of prey choice decisions, Meriam men would do better to collect shellfish instead of spearfishing since the former offer higher net energetic returns. However, many Meriam men never hunt for shellfish and instead focus their efforts on spearfishing. Bliege Bird, Smith, and Bird (2001) suggest that Meriam spearfishing functions as a signal of a man's patience and skill. Indeed, the most skilled spearfishers fish more often than lesser skilled spearfishers, and other Meriam recognize those with the highest average return rates (as measured by Bliege Bird and colleagues) as the best spearfishers, but not those with the highest absolute caloric returns.

Skill and productivity may also be communicated through superficially inefficient horticultural activity, such as the giant-yam-growing found throughout Melanesia (Bliege Bird and Smith 2005). Rather than attempting to grow a large number of yams, men across Melanesia often focus their effort on competitively growing a small number of very large yams. Large yams are generally inedible and thus investing energy in

their production does not return a net caloric benefit. Growing a large yam, however, requires both skill and access to propagules from other large yams, propagules that are acquired through trade networks. Men are able to communicate their skill through the display of large yams and they benefit from political alliances and prestige as a result.

Religion

Across the world, people engage in rituals that are rationalized with reference to supernatural beliefs. From an evolutionary perspective, religion is perplexing because its many manifestations appear nonfunctional or maladaptive. At the very least, ritual behavior involves temporal and energetic costs, but rituals are also often incredibly painful and even dangerous. Anthropologists have applied CST to the study of ritual behavior and suggest that the costliness of ritual behavior ensures that it reliably communicates an individual's commitment to the group or a code of ethics (e.g., Alcorta and Sosis 2005).

Social scientists since Émile Durkheim have recognized ritual's role in building group cohesion and have appreciated that participation in ritual communicates important information about the participants (Rappaport 1999). Irons (2001) grounded these insights in CST and argued that religious behavior is an adaptive solution to large-scale group living. By paying the ritual costs associated with group membership, individuals can demonstrate group commitment, and these demonstrations promote high levels of trust and hence intragroup cooperation. A large body of research now supports the premise that costs paid in the course of ritual behavior return high levels of benefits in the form of increased cooperation.

For example, in a series of studies, Sosis and colleagues examined the survivorship of nineteenth-century secular and religious communes in the United States (Sosis and Bressler 2003). These studies showed that, for every year of their existence, religious communes were more likely to survive than communes founded upon secular ideologies. Moreover, among religious but not secular communes, the number of costly obligations required of members predicted commune longevity; religious communes with more obligations survived longer.

Extending these studies to extant communes, Sosis and Ruffle (2003) conducted common-pool resource experiments on over thirty religious and secular kibbutzim. They found, after controlling for several possible confounds, that the members of religious kibbutzim were more cooperative than their secular counterparts. These differences in cooperation appear to be driven by the higher levels of ritual obligations, most notably daily communal prayer, on religious kibbutzim.

Archaeological applications

Relative to males, females invest substantially more in the development of human offspring. This places females at risk of exploitation by males through abandonment and/or the diversion of resources toward reproductive effort with other women. Thus females

are expected to attempt to secure male investment, while men ought to safeguard against investment in nonfertile women. Knight, Power, and Watts (1995) suggest that, in ancestral human populations, men used menstrual bleeding as a cue for impending fertility, which left females vulnerable to exploitation as men would only be required to invest until conception. This selected for "sham menstruation," whereby all members of female coalitions advertised synchronous menstruation through coordinated body painting when one member of the coalition was menstruating. According to Knight and colleagues, signals of sham menstruation occurred in the context of monthly rituals, communicated coalitional strength, and functioned to manipulate continued male investment. The human ability to symbolize and interpret abstract symbols arose in the context of such ritual signaling and may have led to the emergence of art and dance. This "female cosmetic coalitions" hypothesis generates predictions about when red ochre appears in the archaeological record as a signature of costly ritual.

Work has found evidence of ritual behavior at Rhino Cave, Botswana, that dates to the Middle Stone Age. At the cave, archaeologists Coulson, Staurset, and Walker (2011) uncovered a large number of colorfully decorated spearpoints. These spearpoints never left the cave, were often burned or smashed, and were found alongside pigment. Further, these points were found in front of a modified natural rock formation. Coulson and colleagues used CST to interpret these remains as evidence of early ritual behavior.

Archaeologists have also suggested that CST may help to explain the emergence of religious pilgrimages and pilgrimage centers. For example, Kantner and Vaughn (2012) posit that the pilgrimage centers of both Chaco Canyon in the US Southwest and Cahuachi in southern Peru emerged to signal the status of elites, at a time when pilgrims simultaneously began to signal their group commitment through their pilgrimages. Religious elites benefited from the prestige of large centers and pilgrims benefited from increased cooperation.

Others have applied CST to explain why humans often expend considerable energy building large monuments and decorating material objects. For example, Neiman (1997) suggested that Mayan monumental architecture, which is largely nonutilitarian, signaled political power between competing elites. The construction of large structures signaled wealth and the ability to recruit from a large labor pool. Similarly, Bliege Bird and Smith (2005, 230–31) suggest that the artistic elaboration of Achuar and Quechua pottery may function to signal a woman's skill as a potter. Women who demonstrate their skill through elaborate and difficult pottery may secure better mates, and later in life women use these decorations to signal their political alliances.

Archaeologists Hildebrandt and McGuire (2002) employed CST to explain the emergence of big-game hunting in the archaeological record in California between the end of the Holocene and 1,000 years ago. They argue that the appearance of big game was the result of a shift from more efficient foraging strategies to less efficient big-game hunting and fishing. This shift occurred because hunters began to signal their strength and skill through the difficult and costly capture of big game. Similarly, these authors used CST to explain a shift from foraging to big-game prestige hunting in the Great Basin during the Middle Archaic period.

SEE ALSO: Animal Communication: The Handicap Principle; Behavioral Ecology, Human; Body Ornamentation, Evolutionary Approaches to; Cognition and Communication; *Compadrazgo*; Cooperation, Evolution of; Dual Inheritance Theory; Empathy, Evolution of; Food-Sharing Models; Language, Social Origins of; Linguistics, Anthropological; Ochre and Human Evolution; Optimal Foraging Theory; Reciprocity; Ritual and Cognition; Ritual and Religion, Evolution of; Social Capital; Sociobiology and Anthropology; Symbolic Culture, Origins of

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