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COSTLY SIGNALING
The ABCs of Signaling Theory and Religion

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Devorah is a *ba'al tshuva*—that is, she grew up in a secular Jewish household but has adopted a religious Jewish lifestyle, or more accurately in the parlance of Orthodox Judaism, she has become observant. She recently attended a wedding of new friends in the Orthodox Jewish community of Monsey, New York. At the celebratory meal following the wedding ceremony, the guests, including Devorah, stood in line to ritually wash their hands before breaking bread. Devorah watched as the women (men and women eat separately at such festivities) poured water three times over each hand and then recited a blessing thanking God for the commandment of handwashing. She also noticed that the women all took off their rings and held them in their mouths as they ritually purified their hands. Devorah became concerned since she was unmarried and not wearing a ring. When it was her turn to wash, she turned to the woman behind her and asked to borrow her ring. Puzzled, but obliging, the woman handed Devorah her ring. Devorah promptly clenched the ring between her teeth, ritually washed her hands, and then returned the ring to its owner.

This is not an anecdote depicting real events, but rather a joke, although I realize that the majority of readers will fail to see the humor. Popular among Orthodox Jews, it is a joke that finds comedy in the often overly ambitious attempts of newly observant Jews to fit in. I first heard this joke while conducting fieldwork among Orthodox Jews in Israel, and there are dozens like it in which newly observant Jews try to conform to community norms, but comically fail. In this case, Devorah is unable to distinguish what is ritual—pouring water three times over each hand and reciting a blessing—from that which is incidental, namely, holding a ring between one's teeth. According to Jewish law, when ritually washing there must not be a barrier between the water and one's hands, so rings need to be removed. Women sometimes do hold their rings between their teeth while handwashing, although this is not due to ritual obligation; rather, dresses typically lack pockets.

I have begun with this parochial joke because it highlights numerous points that I will make in this chapter. First, religions consist of repertoires, or collections of patterned behavior that are expected to be performed accurately and in a specific order. Reciting the blessing before handwashing, for example, will just not do. Second, and consequently, these repertoires are difficult to imitate; they are often so detailed that they require considerable time and energy to learn and perform. Third, community members observe the ritualized behavioral repertoires of others. They notice the details and they judge and socially police these repertoires accordingly.

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Fourth, correctly or incorrectly engaging in these repertoires communicates information to others in the religious community. Not only does this joke elicit laughter among Orthodox Jews, if the joke portrayed an actual incident, the women in line would be laughing as well. Devorah has, unintentionally, communicated something to others attending the wedding. Fifth, part of what is being communicated in these repertoires is one's status as a member of the group. Devorah has marked herself as someone who did not grow up in this community, as even young children raised in this community would be able to distinguish the critical from the incidental parts of ritual handwashing. Sixth, those with low social status will be overly zealous in imitating high-status group members. Part of what makes the joke credible among Orthodox Jews, and funny, is that it is widely recognized that newly observant Jews tend to be excessively pious in their attempts to signal their commitments to the rest of the community (Benor, 2012; Danzger, 1989; Glanz & Harrison, 1978; Levin, 1986). These newly observant Jews may not be holding their neighbors' rings between their teeth, but they are doing other things that publicly distinguish them from native born or long-time members of the community. Seventh, the social context—namely, that the joke takes place in a religious environment—is vital for making sense of the entire scenario.

In this chapter I present a theoretical approach that unifies and functionally interprets these observations. The approach offers an evolutionary understanding of religion that has been developed and pursued by biologists, anthropologists, psychologists, philosophers, historians, and cognitive scientists under many names and guises, including hard-to-fake sign of commitment model (Irons, 2001), commitment theory (Atran & Norenzayan, 2004; Bulbulia, 2004), honest signaling theory (Bulbulia & Sosis, 2011), costly signaling theory (Cronk, 1994; Sosis, 2003), and credibility enhancing display theory (Henrich, 2009). I will refer to these approaches collectively as *evolutionary signaling theory*, or more simply, signaling theory. Many good surveys of this literature exist (Bulbulia & Sosis, 2011; Shaver & Bulbulia, 2016; Sosis, 2006), and my intention is not to replicate those reviews here. In other words, this chapter does not offer a comprehensive presentation of the theory or review all of the studies that have been brought to bear on signaling theory and religion. My goals are more modest. I will present a brief overview of the theory, define its key terms, describe a framework for analyzing religious signals, situate the evolutionary signaling theory of religion within the broader field of signaling theory, and conclude by considering the potential role of signaling theory in the academic study of religion.

Religion as Communication

When most people consider religion and its myriad of moral strictures, bizarre rituals, puzzling myths, exotic gurus, and mysterious mystics, "communication" is not the first thought that comes to mind. Indeed, communication evokes images of information, clarity, and pragmatic interactions, whereas religion is shrouded in mystery and grapples with unfathomable existential issues. Nonetheless, drawing on the work of ethologists and their study of animal rituals, anthropologists have long considered religion a form of communication (Leach, 1976; Rappaport, 1968; Wallace, 1966). Religions often use "standard" forms of communication, such as speaking, singing, and writing, but they most effectively and uniquely communicate through what I refer to as the three B's (Sosis, 2006): religious behavior (ritual), badges (the physical manifestations of some ritual behaviors, such as tattoos or religious garments), and bans (behavioral restrictions or taboos).[1] When individuals pray to deities they may be attempting to "communicate" with these supernatural agents, however, for understanding the selective pressures that have shaped prayer and other religious behaviors, badges, and bans, it is important to recognize the congregants, not the gods, as the most relevant communicants.

Signaling theory aims to understand the selective pressures that favor reliable communication between organisms, including congregants in the pews. Sometimes reliable communication is straightforward because it is in everyone's interest to do so. There is little motivation for congregants to deceive each other about their favorite scone recipes, so when Fred and Bill exchange their favorites, they are likely to be doing so honestly. But often, individuals can increase their gains—whether fitness, money, mates, prestige, territory, etc.—by manipulating others to their advantage through their communications (Dawkins & Krebs, 1978). It is under such conditions, specifically, when interests do not align, that honest communication becomes puzzling from an evolutionary perspective. Yet, it is evident that despite conflicts of interest and the potential for gain, honest forms of communication have repeatedly evolved across taxa. The question is: what mechanisms have enabled such communication to evolve?

Behavioral Ecology and Signaling Theory

Before addressing this question, some background on the theoretical underpinnings of signaling theory is necessary. Evolutionary signaling theory is derived from behavioral ecology, which is the application of the theory of natural selection to the study of behavioral adaptation and design in an ecological setting (Winterhalder & Smith, 1992). Human behavioral ecology extends the theoretical perspective and methodological tools of animal behavioral ecology (Krebs & Davies, 1993) to the study of human populations. Behavioral ecologists assess the degree to which behavior is adaptively adjusted to environmental conditions, broadly defined to include ecological and social parameters (Smith et al., 2001). They use variation in environmental variables to explain variation in behavior. Environments are vital to the study of adaptive design because traits are only adaptive in relation to a specific environmental context. Behavioral ecologists describe themselves as biological accountants (Emlen, 1997); they measure the costs and benefits of behavior in order to understand the selective pressures that have acted on decision rules and assess whether individuals are responding adaptively to current environmental conditions. Behavioral ecologists place great emphasis on the phenotypic plasticity of behavioral traits. That is, they assume that selection has designed behavior producing mechanisms (e.g., human nervous system) to be flexible enough to respond to a range of environmental conditions. The foci of study are typically conditional behavioral strategies, which take the form: if facing condition *A*, do *X*; if facing condition *B*, do *Y*, where *X* and *Y* are assumed to maximize fitness in their respective environments.

Behavioral ecologists are largely agnostic with regard to the psychological mechanisms that produce adaptive responses. This agnosticism toward cognition and psychological design is particularly important for understanding signaling theory, especially as cognitive researchers attempt to employ these models for explaining religious behavior and cognition. As Searcy and Nowicki (2005, p. 5) note in their masterwork on signaling theory:

> [W]e are interested in how natural selection shapes communication to be either honest or dishonest. From this viewpoint, the question of mental states is largely irrelevant; the costs and benefits to the signaler of giving a false alarm, and to the receiver of responding, ought to be the same whether or not the signaler is able to form an intention and receiver to form a belief.

This agnosticism is not a rejection of any particular psychological mechanism, or an assumption that no mechanisms can be discovered. Rather, behavioral ecologists start with the assumption that selection has produced behavior-generating mechanisms that enable organisms to respond

optimally, given design constraints and tradeoffs, to environmental conditions. As Smith and Winterhalder (1992, p. 53) argue:

> Given sufficient genetic variation and consistency of selection pressures, it is plausible that one of its cumulative results will be a trajectory improvement in designs. The result may be a design that can be fairly characterized as optimal with respect to the fitness currency, the design problem, and the relevant constraints.

Optimality models assume adaptive response patterns and deviations from predictions of the models allow researchers to better understand the constraints facing decision-makers. Thus, behavioral ecologists generate hypotheses from simple optimality models, which are tested against empirical evidence and results are used to evaluate, discard, or modify the models.

Evolutionary signaling theory offers a set of optimality models that aim to understand the selective pressures that have shaped the design of signals (Maynard Smith & Harper, 2003). As derived from behavioral ecology, evolutionary signaling theory focuses on the environmental conditions that favor particular signaling strategies. Specifically, it aims to understand the fitness costs and benefits of sending and receiving signals. But what do behavioral ecologists mean by terms such as sending, receiving, and signals?

Basic Definitions

Let's begin with *signal*. A signal, in evolutionary signaling theory, is a trait that evolved to alter the behavior of an observer for the benefit of the organism that is displaying the trait (Endler, 1993; Otte, 1974). In the joke that opened this chapter, wearing or not wearing a wedding band is a signal, specifically a badge (see Cronk & Dunham, 2007). But the primary signal of the joke is ritual handwashing: pouring water over each hand three times (there are different traditions regarding whether this is done consecutively or alternating between hands) using a washing cup and reciting a blessing. The characteristics of the washing cup, the order of the washing (right hand first), and the precise wording of the blessing are all defined by Jewish law (*halacha*), and they are all part of the signal. Thus, like most religious signals, the signal consists of a repertoire; that is, a series of behavioral actions that are expected to be performed as a unit and in a particular order.

Signals are of course performed or displayed; those performing or displaying are referred to as *senders*. In the joke, there are multiple senders. Devorah is the focal sender, but the other women she is observing are also senders, sending signals to Devorah and the other attendees of the wedding.

Signals must also have *receivers*. Receivers in the joke are Devorah and the other women who observed Devorah washing her hands. Two other sets of receivers are common in religious contexts and thus worth mentioning. First, sometimes religious repertoires are auto-communicative (Rappaport 1999); in other words, the primary receiver of the signal is oneself. Elsewhere I have argued that private religious practices are particularly effective at signaling to oneself, and convincing oneself, of one's religious beliefs and commitments (Sosis, 2003). Although by definition private practices are performed alone, there can be occasions where such practices are viewed by others, and failure to perform appropriately at such times can have social repercussions. Second, receivers of religious signals are often outgroup members. As we will discuss below, religious signals may not have evolved to serve as signals for outgroups, but outgroup members can co-opt the information in these signals to assess characteristics of the sender (Sosis, 2005).

The signal, sender, and receiver constitute a *signaling system* (Hebets et al., 2016). Signaling systems can be made up of one signal, or more commonly, especially in a religious context, multiple signals. Religious practices are often interconnected such that sending a religious signal is only effective if it is performed or displayed in conjunction with the signals to which it is linked (Sosis, 2019). For example, praying five times a day as a Muslim would not be an effective signal of piety or devotion to the community if ham sandwiches were consumed between prayers. Recognizing these linkages and the dynamics of signaling systems is important because taking signals out of their context for analysis, as is common in the scientific study of religion, can produce highly misleading results (Sosis, 2017).

To conclude this section, I distinguish signals from *cues*. Signals are shaped by selection for their communicative functions. Cues, on the other hand, are incidental characteristics that are informative, but did not evolve for their information value or to alter receiver behavior. For example, many ultra-Orthodox Jewish men wear glasses as a consequence of a lifetime of studying religious texts with agonizingly small print. Wearing glasses may be a cue of studying diligence, but it is not a signal since selection pressures (whether natural or cultural selection) have not favored wearing glasses to communicate such diligence to others. The boundaries between signals and cues, however, are often difficult to distinguish because cues may evolve into signals if the information they convey is beneficial to receivers (Biernaskie et al., 2018).

Cues are particularly important when studying religious signaling since many reputed religious signals are likely to have initially emerged in the cultural practices of communities for reasons other than their current signaling functions. For example, Jewish ritual handwashing prior to meals may have originally served hygienic functions.[2] But if so, at some point in Jewish history handwashing began to serve as an ingroup marker, not just marking observant from nonobservant or newly observant Jews, but distinguishing Jews from gentiles. It seems likely that Jesus' rejection of Jewish handwashing practices (Luke 11:38; Matthew 15:2; Mark 7:2–5) played a role in transforming this ritual from a cue to a signal. For example, The Talmud (*Chullin* 106a) tells the story of a Jewish inn owner who had the practice of serving kosher meat to those who ritually washed before sitting down to eat, and pork to those who did not. Handwashing thus served as a signal of Jewish identity and the Talmud reveals—as a warning—that Jewish customers who failed to ritually wash, unwittingly ate pork.

Conditions for Reliable Communication

There are various conditions under which we would expect reliable communication to evolve. The most common conditions, as discussed above, occur when interests align between sender and receiver. Interests may align along a particular trait even among competitors, such as when a fast and healthy prey animal wants to signal its speed to a predator, thus favoring reliable communication between them (Cronk, 2005). But alignment of interests are not the only conditions under which we expect reliable communication. Here I discuss four other conditions that would lead to reliable communication.

First, when senders and receivers regularly interact reliable communication can emerge (Rich & Zollman, 2016). Indeed, when individuals know one another throughout their life course we expect reputations to guide social interactions because previous social engagements will be well known to everyone involved. This is important because high levels of religious signaling within some close-knit religious communities are sometimes interpreted as signaling trustworthiness and group commitments, but close-knit communities should not need such signals since they will be well aware of the reliability of their fellow group members. Rather, it seems that the demands these groups place on their members serve to signal their commitments

to anonymous, or less well known members of their same religious affiliation (Sosis, 2005), essentially expanding the functional group size (Dunbar & Sosis, 2018).

Second, reliable communication can emerge when potential senders face differential benefits for displaying or performing a signal, most commonly due to greater need for the anticipated response of the signal. For example, while conducting fieldwork in the northern Israeli town of Tzfat, religious Jews would regularly come to my house and request alms. Among these beggars there appeared to be an arms race for limited charitable funds. Nearly every beggar came with a letter from a rabbi documenting the verity of their hardship, such as illness, widowhood, overdue rent, wedding dowries, and so forth. Some beggars would display letters from multiple rabbis and I encountered more than one who went door to door with a full binder of letters and pictures detailing the authenticity of their financial plight.

Third, some signals are actually impossible, or nearly impossible, to fake and are consequently quite reliable. These are referred to as indexical signals (Biernaskie et al., 2014). More generally, an index is a signal that refers to what it denotes by being truly affected by it. For example, some Muslim men develop a prayer bump on their foreheads known as a *zabiba* (literally, raisin) as a result of prostrating with their foreheads to the floor five times a day during Muslim prayer (Abanmi et al., 2002). Another example is circumcision, which during World War II was a dangerous and unalterable sign of Jewish identity among males, although there are reports of those who attempted to alter this badge (Perel, 1997).

Fourth, and most famously, Israeli biologist Amotz Zahavi (1975, 1977) recognized that when it is in an organism's best interest to send a dishonest signal (such as, I'm really much bigger, quicker, stronger, healthier, or more beautiful than I actually am), the signals that are most believable are those that are costly-to-fake. He referred to such signals as handicaps. Handicaps are reliable because they are too costly to display or perform for those of low quality (in other words, those who are smaller, slower, weaker, sicker, and uglier than they want others to believe they are). All behaviors incur time and energy costs, as well as the costs of missed opportunities when performing one behavioral alternative over another. Costs which extend beyond these baseline costs (also known as efficacy costs) are called strategic costs. Strategic costs can take the same form as baseline costs of production (for example, time and energy), but also often include the risk of consequences if a false signal is discovered.

Zahavi argued that selection has favored handicaps in a variety of species (see Zahavi & Zahavi, 1997). However, this has been more difficult to confirm than is generally appreciated. As the British evolutionary biologists John Maynard Smith and David Harper (2003) explain, for a signal to classify as a handicap the net benefits for displaying the signal must be higher for a high-quality individual than a low-quality individual. This could mean one of three possibilities: that the costs are higher for low-quality individuals, that the benefits are higher for high-quality individuals, or both (see Figure 16.1). Critically, to classify as a handicap it must be possible to send a false signal, in other words, for a low-quality signaler to send a signal suggesting high quality. The signal must be costly-to-fake, but not impossible-to-fake. The handicap principle asserts that low-quality signalers generally do not send false signals because it simply does not pay; the net costs are too high (Bliege Bird & Smith, 2005).

Despite being the most well-known and well-studied of the mechanisms that stabilize reliable communication, I have discussed the handicap principle last because many researchers in the cognitive and evolutionary sciences of religion mistakenly equate signaling theory with the handicap principle. But signaling theory offers a much broader class of signaling models, many of which are at least as important as the handicap model for understanding religion, if not more so. Researchers studying religious signaling often identify a costly religious behavior

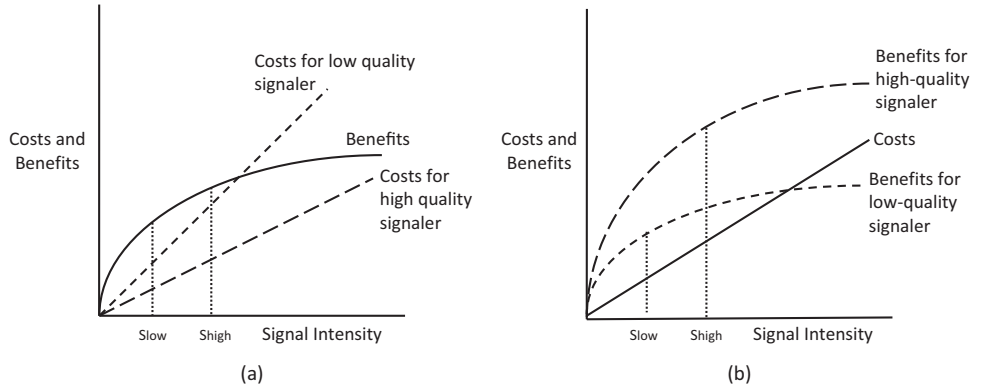

Figure 16.1 Graphical illustration of how differential costs or benefits can maintain signal reliability. Optimal signal intensity is higher for high-quality signalers than low-quality signalers under conditions in both graphs. (a) All signalers gain the same benefits but low-quality signalers pay higher costs than high-quality signalers. (b) All signalers pay the same costs but high-quality signalers gain higher benefits than low-quality signalers (adapted from Johnstone 1997, p. 168)

and reflexively apply Zahavi's argument to explain its emergence and persistence. But as Barker et al. (2019, pp. 87–90) note:

> this 'cost-first' approach contrasts with how signals are studied in behavioral ecology, which can be thought of as a 'content-first' approach. Researchers start by identifying a putative signal and then construct hypotheses about what factors have shaped it, for example, what the benefits are of signaling versus not signaling or what (if any) costs signaling may entail.

A Framework for Analyzing Religious Signals

Signaling models, as discussed above, focus on behavior that has been selected for its strategic value as a form of communication that influences the response patterns of receivers. But all behavior has the potential to provide information to observers, making the array of possible signals overwhelming and bewildering. Therefore, a framework for identifying and analyzing signals is vital for advancing the evolutionary study of signaling. Barker et al. (2019) developed such a generalized framework in which they urge researchers to clarify the content, context, and costs of the signals under examination. Let's consider each these with regard to religious signals.

Content

Barker et al. (2019) define content in terms of the strategic value of a signal for both senders and receivers. Specifically, the content of a signal refers to the attributes of the sender that a receiver assesses from the signal. In other words, the content of a signal consists of the attributes of the sender as interpreted by the receiver. Content may also refer to the attributes of the environment that a receiver assesses from the signal, and some signaling systems may carry information about both the environment and attributes of the sender. For example, in a series of pioneering studies in the Tyva Republic, Benjamin Purzycki (2010, 2011; Purzycki & Arakchaa, 2013)

established that ritual activities around cairns mark territorial boundaries, signal a performer's acknowledgement of crossing into a neighboring territory, and that while in the territory they intend to abide by the owner's norms and customs.

Barker et al. (2019) further delineate the attributes of senders by distinguishing their capital (material, embodied, and social capital) from their character (values and commitments). All of these attributes were evident in Eleanor Power's (2017a,b) detailed ethnographic work among Tamil Nadu villagers in South India. Power showed how the fulfilment of vows at Hindu festivals served as signals among co-residents. The vows, which included fasting, sacrificing goats, body piercings, and fire walking, are intended to elicit the support of deities for various needs, such as curing an illness, becoming pregnant, or securing a job. Power's research demonstrated that observers understood the fulfilment of specific vows to indicate particular attributes of the performers, revealing wealth (material capital), strength (embodied capital), social support (social capital), devotion to a deity (value), and dedication to the religious group (commitment).

One of the challenges of applying signaling models to human behavior, and an understandable point of confusion, is that different receivers can assess the same signal differently. This is not unique to human religious signaling. Animal researchers refer to signals that elicit multiple meanings as pluripotent (Hebets et al., 2016). For example, during his fieldwork among Orthodox Jews in Los Angeles, secular Israeli sociologist Iddo Tavory began to wear a kippah to fit in with, and out of respect for, the people he was studying. While on the streets of Los Angeles, however, while donning a kippah he was often asked questions about Jewish law by strangers who had assumed he was religiously knowledgeable and possibly a rabbi (Tavory, 2016). As this example illustrates, pluripotency does not render signals ineffective; such signals can still have probabilistic effects on receivers. Rather, as Barker et al. (2019, pp. 90–91) point out, "it simply implies that the effect will be different for different classes of receiver (e.g., males versus females, in-group versus out-group)."

Costs

As noted above, in the religious signaling literature there has been an overemphasis on costs. In addition to the methodological problems noted above of the "costs-first" approach, the overemphasis of costs in the religious signaling literature has left many with the impression that signaling theory is only relevant for explaining costly religious displays. This is unfortunate since the overwhelming majority of religious signals are subtle and not particularly costly, such as the handwashing ritual described above. Signaling theory is well-equipped to determine the conditions under which selection will favor the emergence of such signals (Bliege Bird et al., 2018; Reichard & Anderson, 2015; Silk et al., 2000). Nonetheless, costs are an important mechanism, as described above, through which receivers can be confident in the reliability of a signal.

Costs can be paid in various ways and Barker et al. (2019) distinguish between audience independent costs and audience dependent costs. Audience independent costs include capital that has been expended, transferred, risked, or forgone. Returning to Power's (2017a,b) work in India, fulfilling vows entails all of these costs. Vows often require financial investments, the sharing of food with others, the risk of physical harm, and the opportunity costs of time and money not spent on other activities. Audience dependent costs are obviously influenced by receivers and include the risks imposed by receivers on signalers and opportunities with receivers that are forgone by signalers. Those fulfilling vows in South India, for instance, risk social discrimination for their vows, particularly by outgroups, and during fasting they forgo

opportunities for social engagement with others in the community. Moreover, those who fake their vow commitments face the risk of exposure and consequent reputation loss and social ostracism.

The fieldwork of Iddo Tavory (2016), mentioned above, provides another example of audience dependent costs. During fieldwork he dressed and generally behaved as an observant Jew, but when one of his hosts read his academic writings in which he professes his secular identity, he faced a loss of trust among some of the participants in his study. He also describes how wearing a kippah exposed him to anti-Semitism that he would not otherwise have experienced.

As a final example I return to the joke that opened this chapter. The audience dependent costs that Devorah likely faced were not just social embarrassment. It has been well documented that *ba'alei teshuva* (newly observant Jews) who enter Orthodox, especially ultra-Orthodox, communities are unlikely to be welcomed as equals (e.g., Levin, 1986; Telushkin, 1991). In his book on ultra-Orthodox (*Haredi*) life David Landau (1993, pp. 248–249) writes,

> *Haredism's* celebration and absorption of the *teshuva* movement is not necessarily matched by a wholehearted acceptance of the individual *ba'al* or *ba'alat teshuva* into the *Haredi* family. The litmus test is marriage, and here *ba'alei teshuva* often find their paths blocked by an informal but strongly entrenched discrimination … The whispered assumption in *Haredi* circles is that if a *Haredi*-born boy or girl marries a *ba'al teshuva*, there must be 'something wrong' with him or her: either they are poor, or they have a health disability.

This bias against *ba'alei teshuva* occurs despite a recurring emphasis in Jewish liturgy and law on accepting the proselyte as a full member of the community. It appears that those born into the *Haredi* community recognize that the costs of membership are too high to be paid without early indoctrination (see Sosis, 2003). The devotion of the *ba'alei teshuva* is not doubted by the *Haredi*-born; ironically, because of their willingness to embrace the costly strictures of *Haredi* life, it is their rationality that seems to be in question (Levin, 1986).

As a final remark on signal costs, it is worth noting that risked signal costs are sometimes never realized. For the empirical investigation of religious signals this is a particularly challenging issue because costs that are not realized are difficult to measure. Nonetheless, recognizing these potential costs is important when analyzing the dynamics of signaling systems as they undoubtedly influence the stability of signals (Barker et al., 2019).

Context

Context is a vital, yet underappreciated, aspect of signaling. As with all adaptations, signals are only adaptive in relation to a certain environment. Thus, signals should always be described in relation to a specific socio-ecological context. Cultural environments invariably influence the efficacy of the signal: wearing a kippah on the streets of Paris, Phnom Penh, and Tel Aviv will have different signaling values and consequences. Ritually handwashing at a Jewish wedding celebration and ritually handwashing at McDonalds are different things entirely. As these examples suggest, probably the most important aspect of the signaling context is the audience. Are signal receivers ingroup or outgroup members? Are they potential mates or intrasexual competitors? Are there potentially unintended receivers? Expectations about the audience are likely to influence the intensity and frequency of signaling displays (Reichard & Anderson, 2015). But the context can also have audience independent impacts on the costs. For example, purchasing Jewish material culture, such as *tefillin*, *mezuzot*, religious books, and

art, is much cheaper and easier to find in Israel than in the Jewish diaspora, thus affecting the value of their display.

Barker et al. (2019, p. 94) emphasize that in addition to contextual costs, "[s]ignals may vary between socioecological settings… due to different contextual constraints." For instance, as economist Eli Berman (2000) demonstrates, to signal their commitment to the ultra-Orthodox community, male ultra-Orthodox Jews in Israel often remain in yeshivot until after 40 years of age, which results in a draft deferment and extreme poverty. But in the US, without the draft, remaining in yeshivot for such a long time among ultra-Orthodox Jews rather implies some dysfunction and inability to enter the mainstream market economy.

Recognizing context is particularly important for interpreting experimental signaling results (e.g., Ruffle & Sosis, 2020). Consider McCullough et al.'s (2016) study of Christian badges. McCullough and colleagues showed that Christians and non-Christians were more trusting—as measured in a survey questionnaire and economic game—of individuals wearing ashes on Ash Wednesday, and in a follow-up study, of those wearing a cross necklace. The finding that religious badges could instill trust in outgroup members was surprising from perspectives that posit an evolved coalitional psychology, but it was precisely the type of adaptive flexibility expected by behavioral ecologists and had been theoretically anticipated more than a decade earlier (Sosis, 2005). Hall et al. (2015) similarly found that Christians showed increased trust for Muslims who engaged in costly religious signaling, such as adhering to dietary bans and donating to charity, both of which are Muslim religious obligations. The findings of these studies are important, but they were both conducted among undergraduates, in Connecticut and Arizona respectively, which is an important contextual factor when interpreting the results. As McCullough et al. caution, the religious heterophily in the United States, especially on a college campus, makes it likely that non-Christians extend their trust to Christian strangers because they can generalize from their experiences with Christian friends and neighbors. Recognizing contextual factors, these authors:

> wonder whether the effects of religious badges on trust covary cross-culturally with the strength of secular legal institutions … [and] whether these results would replicate in nations in which religious groups are currently, or have recently, been locked in particularly strenuous or violent political conflict
>
> *McCullough et al., 2016, p. 161*

Situating Signaling Theory

Barker et al.'s framework is derived from animal and human behavioral ecology. But other academic fields also employ signaling models, so it is worthwhile to consider the differences between these distinct disciplinary approaches. Here I discuss signaling theory in cultural evolution and economics.

Cultural Evolution

The early signaling models that were employed to study religious phenomena (e.g., Bulbulia, 2004; Cronk, 1994; Irons, 2001; Sosis, 2003) have been useful for investigating the relationship between socioecological factors and signal design, but they paid little attention to the transmission of signals across time and space. These models emphasized the importance of early indoctrination (Sosis, 2003) and experience-expectant learning windows during adolescence (Alcorta & Sosis, 2005). Cultural evolutionists extended these early models to examine the cognitive

learning biases involved in the diffusion of religious signals. Most notably, anthropologist Joseph Henrich (2009), developed a model, known as CREDs, showing the conditions under which selection favors attentiveness to religious displays and how such displays can be transmitted within and across generations (See Turpin and Lanman, Chapter 17 in this volume).[3] Various recent studies have sought to test predictions derived from this model with mixed success (e.g., Langston et al., 2020; Turpin et al., 2019), but regardless of the current empirical support, the incorporation of social learning into signaling models is an important advance and will help to bridge behavioral ecological and cultural evolutionary approaches to the study of religion.

Some of this work has already begun. Wildman and Sosis (2011), for example, developed an agent-based model to broaden Henrich's pioneering work. Henrich's model showed that under a wide array of environmental conditions, a costly-display stable equilibrium coexists with a no-cost stable equilibrium, in which individuals do not perform any costly displays. Populations gravitate toward one or the other based on the initial frequency of costly displays in the population. As Henrich recognizes, this result is somewhat unrealistic since even within religious groups that are characterized by high levels of signaling, there is considerable intracultural variation (e.g., Sosis, 2009). Wildman and Sosis' agent-based model, however, generalizes Henrich's result to the more realistic situation of a population peppered with subgroups committed to high-cost beliefs and practices. Unlike in Henrich's model, which has no group differentiation within the population, the agents in Wildman and Sosis' model use success-weighting calculations to determine whether to join or leave high-cost groups. According to their model, high-cost groups, especially those with charismatic leaders, can achieve long-term stability within a larger population under a wide range of circumstances.

Economics

Signaling theory had its own independent development within economics, dating back to at least Thorstein Veblen (1899). Given this deep history, it is not surprising that economists were the first to recognize that signaling theory was a powerful tool for understanding seemingly irrational and bizarre religious behavior (Carr & Landa, 1983). Economists have continued to develop sophisticated signaling models, so it is fair to ask: is evolutionary signaling theory genuinely needed to study religion? What is gained by employing evolutionary rather than economic models?

Let's briefly consider economic signaling models. Lawrence Iannaccone (1992, 1994) published a series of influential papers that has served as the bedrock for the economics of religious signaling. He observed that the satisfaction that individuals get out of religion depends not only on their own investments, but also on the investments of others. If you are one of twenty people sitting in a sanctuary that seats five hundred, it is hard to get emotionally riveted—but if it is necessary to put seats in the aisles and the congregants know the service and participate enthusiastically, one's own enjoyment of the experience also increases. Iannaccone argued that stigmas and sacrifices (our behaviors, badges, and bans) served to weed out those who were not fully committed to the congregation so that those who are committed can maximize their enjoyment (or in economic jargon, "utility") by being surrounded by others who are similarly committed to the congregation. Iannaccone offers several elegant models to clarify his arguments and he rigorously tests the theory with data from various sources. For example, he shows that in a sample of American Christian denominations the communities with the strictest demands, such as the LDS Church and Seventh Day Adventists, have the highest levels of church attendance and prayer frequency. He attains similar results comparing Orthodox, Conservative, and Reform Jews.

From a selectionist perspective, the trouble with the purely economic approach to religious signaling is that it is unlikely that natural selection would design humans to participate in all sorts of costly activities just so they can sit in church with others who know all the hymns. What evolutionary models offer are a reason why we might expect a correlation between rituals, taboos, badges, and church or synagogue attendance—they all serve as signals of group commitment that enable groups to overcome inherent problems of cooperation (Irons, 2001). Throughout our evolutionary history humans have faced problems of cooperation, many of which were vital to our survival, including hunting and warfare (Sosis et al., 2007). While most of us forage in a supermarket these days, and few of us have been on a battlefront, religion continues to serve as a mechanism that solves collective action problems that arise, especially in economic domains, and allows groups to offer mutual insurance benefits that would otherwise be exploited to depletion (Hartberg et al., 2016; Johnson, 2005).

The evolutionary signaling theory of religion maintains that increased commitment among the faithful will translate into successful cooperation, not just more members in the pews, and that high prestige cooperators will leave more descendants on average than others. Groups that require more of their members, up to some environmentally delimited optimum level, are generally expected to achieve the highest levels of cooperation, whereas groups that demand less of their members will find it more difficult to achieve collective goals. In ethnohistorical work, Sosis and Bressler (2003) found that among nineteenth-century US communes—which faced, like all communes, inherent free-rider problems—religious communes did indeed demand more of their members than their secular counterparts, such as celibacy, relinquishing all material possessions, and vegetarianism. Statistical analyses revealed that religious communes that demanded more of their members survived longer, but there was no relationship among secular communes between the requirements imposed on members and commune longevity.

We were surprised by this latter result since secular groups, such as militaries and college fraternities, appear to successfully employ costly rites to maintain cooperation. While both religious and secular practices can promote cooperation, religious practices may ironically generate greater belief and commitment because they sanctify unverifiable ideologies. Due to their reliance on supernatural elements, religious theologies are generally beyond the possibility of examination; indeed, contemporary religions struggle when they extend beyond this border into convictions that can be evaluated, such as claims that we reside on a 6,000-year-old flat planet, orbited by the sun. In contrast, secular ideologies are subject to the vicissitudes of examination and are thus less stable than religious ideologies (Rappaport, 1999). Successful secular groups often incorporate unverifiable elements into their ideologies, such as "brotherhood" and "liberty," both of which are commonly trumpeted in fraternities and militaries. The ability of religious practices to evoke emotional experiences that can be associated with enduring supernatural concepts and symbols differentiates them from secular rituals, badges, and bans and may explain why they achieve greater long-term commitment and cooperation, as was evidenced in Sosis and Bressler's sample of nineteenth-century communes.

Subsequent work has extended these historical results to modern communities. First, Sosis and Ruffle (2003; Ruffle & Sosis, 2007) conducted common-pool resource dilemma games aimed at measuring cooperation on Israeli communes known as kibbutzim. Controlling for effects such as the age of the kibbutz, level of privatization, size of the kibbutz, and numerous other variables, they showed that members of religious kibbutzim exhibited higher levels of intra-group cooperation than their secular counterparts. Moreover, Dunbar and Sosis (2018) showed that both religious kibbutzim and nineteenth-century US religious communes were able to sustain larger community sizes than their secular counterparts, presumably a

consequence of their greater social cohesion. Second, research on college fraternities sought to determine whether costly secular rituals increased cooperation and bondedness, as signaling theory anticipates (Shaver et al., 2018). However, similar to Sosis and Bressler's findings, Shaver and colleagues found that there was no relationship between costly obligations or rituals and cooperation across fraternities, even though fraternities exhibited much higher levels of cooperation than other university groups.

Future Considerations

The academic study of religion suffers from a deep division between those employing humanistic and scientific frameworks. This is a divide that I am all-too familiar with in my home discipline of anthropology. Over a decade ago, Bliege Bird and Smith (2005) argued that signaling theory offered an opportunity to integrate humanistic and scientific theories within anthropology. While their article inspired interest in signaling theory among evolutionary anthropologists and archaeologists, lamentably, the integration they envisioned never materialized.

I share their vision and I hope that this chapter will serve to initiate a much-needed integration of the sciences and humanities within the academic study of religion. Critically, while humanities research has emphasized meaning, experience, power, symbolic action, and history, it is clear from the discussion above that signaling theory demands attention to these domains as well. Moreover, the humanistic commitment to holism (Buskell et al., 2019; Lang & Kundt, 2020; Sosis, 2020a) is precisely what will be required of the next generation of signaling research as we further appreciate the systemic cultural web in which all human signals are embedded. I do not naively believe that signaling theory is a panacea for the unfortunate division in the academic study of religion, but I do believe that it offers a framework for a shared conversation that could lead to a deeper appreciation of the important research being pursued by both humanistic scholars and scientists.

Regardless of whether or not such an integration develops, the application of signaling theory to human social contexts is not without its significant challenges. One challenge, of interest to both humanities scholars and scientists, concerns how signals are transformed from voluntary to compulsory acts; that is, how signals become institutionalized. Ritual handwashing, for example, has long been institutionalized within Judaism (see Sosis, 2020b). Once institutionalized, such signals generally carry the weight of punishment, with differential incentives across individuals and groups for imposing punishments and paying their inherent costs. Moreover, if policing mechanisms are effective, the original heterogeneity of a signal will be suppressed, resulting in a decline in value of the signal (e.g., Kiper & Sosis, 2017). Future work will need to develop a plausible theory for how signals become institutionalized, how power asymmetries impact institutionalization, and how signal costs, which are often unobservable in institutionalized environments, can be assessed.

Cultural anthropologists have criticized evolutionary anthropologists for overgeneralizing and obscuring the importance of local context in cultural analyses (e.g., Sahlins, 1976). Whether such criticisms have been merited or not, it is clear that local context is essential for uncovering the function and meaning of signaling behaviors. Ethnographic fieldwork, still the central methodological tool for all anthropologists studying extant cultures, can provide the essential details of local context—"thick description" as Geertz (1973) would have it—but work remains on how to operationalize the content and costs within a signaling system. Furthermore, the pluripotent nature of most human signals, disparate relative costs across signals within a system, and extraordinarily complex dynamics of human signaling systems present significant challenges for fieldworkers (Barker et al., 2019). Lastly, all social environments, at least

theoretically, offer a multitude of potential signaling solutions to cooperative and competitive dilemmas. Yet equilibrium dynamics ultimately gravitate toward particular signaling solutions, eliminating the development of alternative signaling outcomes. Future work must explore the factors that influence signaling systems to progress along certain cultural trajectories and not others. The exigent work ahead would benefit greatly from the collaborative efforts of all subfields within the academic study of religion, as well as scholars from diverse disciplines, such as psychology, economics, and evolutionary biology, that have long maintained interest in signaling theory. I hope this article has laid the groundwork for such collaborations.

Conclusion

I began this chapter with a joke, and I will close it with a similar joke—again highlighting overenthusiastic signaling—from a different perspective, but which still illustrates many of the themes discussed in this chapter.

> Before his child heads off to college a father tells his son, "Now remember, don't marry someone who is not Jewish." Sure enough, the son returns home during Thanksgiving and brings his non-Jewish girlfriend with him. Eventually, she converts and after college they marry. On the Saturday after their wedding the son has his breakfast, grabs his briefcase, and begins to head out the door.
>
> His wife asks, "Where do you think you are going?"
>
> "To the office of course," he replies.
>
> "Oh no you are not! I converted so you could go to work on the Sabbath? Put down your briefcase, we are heading to synagogue!"
>
> This went on for weeks and in desperation the son called up the father for advice.
>
> "Dad, she won't let me go to the office on Saturday. What should I do?"
>
> His dad answers, "I told you not to marry someone who is not Jewish."

Laughing at, or at least "getting," each of the jokes conveyed in this chapter is actually a fairly good signal of one's identity. It was acknowledged that only members of the Orthodox Jewish community would understand the humor in the opening joke, but the second joke, which has a secular or non-religious orientation, is more likely to hit the mark with the probable readership—secular academics—of this chapter.

In a chapter that opens and closes with a joke, it seems only appropriate that I conclude by summarizing—a bit tongue-in-cheek—the ABCs of religious signaling. Fundamentally, religious signaling concerns how an audience assesses attributes through religious behaviors, badges, and bans, the costs of which ensure the reliability of the content of these signals in defined contexts. To borrow the final words of Rabbi Hillel when asked to recapitulate the Torah while standing on one foot: "The rest is commentary. Go and learn."

Notes

1 Although the central tenet of religious signaling is that "actions speak louder than words," a fourth B—belief, or more specifically, profession of belief—can sometimes serve as a signal of group identity and commitment, and appears to do so most commonly and effectively in Protestant traditions (see Sosis 2006).

2 Note that this is not the halachic nor normative reason for ritual handwashing, which derives from ritual purity practices in the Jerusalem Temple (Exodus 17–21). Indeed, even if ones' hands have already been washed thoroughly with soap, ritual handwashing is still halachically required before breaking bread.

3 It is sometimes mistakenly claimed that the major contribution of the CREDs model to the study of religious signaling is that it shows how signals can evolve without costs. However, there are many much earlier signaling models that examine the conditions where low- and no-cost signals can evolve (e.g., Bergstrom & Lachmann, 1998; Lachmann et al., 2001; Maynard Smith, 1994; see Barker et al., 2019). As noted above, the advance of the CREDs model was its incorporation of cultural evolutionary dynamics into a signaling framework, which had not been previously explored.

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