

Springer Proceedings in Complexity

Georgi Yordanov Georgiev
John M. Smart
Claudio L. Flores Martinez
Michael E. Price *Editors*

Evolution, Development and Complexity

Multiscale Evolutionary Models of
Complex Adaptive Systems

 Springer

The Building Blocks of Religious Systems: Approaching Religion as a Complex Adaptive System



Richard Sosis

1 Introduction

Over a recent Thanksgiving holiday I visited my parents, who still reside in the house in which I was raised. During the holiday weekend, they invited some longtime family friends over for a meal. I was talking with one of the guests and I asked him how the local synagogue was faring, as I recalled from my youth that he was an active member. About a decade ago, the synagogue in question had moved from its original downtown location to the suburbs to be in closer proximity to the majority of its members, such as my parents. The new building is gorgeous, modern, and considerably larger than the downtown structure, which after more than 50 years as a house of God, was transformed into a hospital parking lot. Our family friend sighed in response to my question and then answered that membership in the synagogue had plummeted in recent years. He noted that it had been assumed that building an elegant facility closer to its constituency would attract more members, but in fact, the move seemed to have had the opposite effect. Surprisingly, membership was about half of what it was in the downtown location. And this was not a result of an exodus of Jews from the area; in fact, the Jewish population in the suburban residential area surrounding the synagogue has likely increased in recent years. It seems, he explained, that Jews who had in previous generations felt an obligation to join the synagogue to support the institution, even if they did not frequently worship there, no longer felt the communal pull to contribute to an institution that they had no intention of using regularly.

Our family friend was not optimistic about the long-term survival of the synagogue. If current trends continued, membership dues would be insufficient to

R. Sosis (✉)
Department of Anthropology, University of Connecticut, Mansfield, CT, USA
e-mail: richard.sosis@uconn.edu

support such a large building. One synagogue tradition that I fondly remembered was the full bagels and lox breakfast spread that followed the daily morning prayers. I knew our family friend had been a regular attendee at the morning minyan, as it is known, so I asked whether he still attends. He responded that despite a membership of several hundred families, they are rarely able to secure a minyan, that is, the minimum of ten people required to say certain prayers. The breakfast tradition had passed into history, although a group of four retirees who are committed to the minyan regularly convene at a local diner for breakfast following prayers. Indeed, our friend confided that he often just skips the minyan and meets the retirees at the diner for breakfast.

I share this anecdote because it captures four, or at least four, important aspects about religion. First, religions respond to local conditions; in other words, they seek to adapt. Sometimes, of course, they fail; history is littered with many more extinct religions than ones that have endured the test of time. This leads to the second observation: religions are difficult to predict, even for those who are actively engaged in the religion. The leaders of the synagogue I grew up in quite reasonably thought that moving the synagogue would benefit the community, not contribute to its demise. Third, and at the moment probably less apparent than the first two points, ritual is the lifeblood of religions. As I explained to our friend, I did not think the minyan was failing because membership rates were falling (with several hundred families, they could have easily supported dozens of minyanim) but rather that membership was falling because the minyan itself was failing. The fourth point is implied by the previous three aspects: religions are systems.

These insights stem from an approach to religion that I have advocated over the past decade (Sosis 2009, 2016). Specifically, I have proposed with my colleagues Candace Alcorta (Alcorta and Sosis 2005, 2006; Sosis and Alcorta 2003, 2004), Benjamin Purzycki (Purzycki et al. 2014; Purzycki and Sosis 2009, 2010, 2011, 2013), John Shaver (Shaver et al. 2016; Sosis and Shaver 2015), and Jordan Kiper (Kiper and Sosis 2014, 2016; Sosis and Kiper 2014a, b, 2017) that religion may best be understood as an adaptive complex of traits incorporating cognitive, neurological, affective, behavioral, and developmental elements. We argued that these traits derive from prehuman ritual systems and were selected for in early hominin populations because they contributed to the ability of individuals to overcome ever-present ecological challenges. By fostering cooperation and extending the communication and coordination of social relations across time and space, these traits served to maximize the potential resource base for early human populations, thereby increasing individual fitness. The religious system is an exquisite, complex adaptation that serves to support extensive human cooperation and coordination, and social life as we know it.

The goal of this chapter is to describe the religious system, or specifically, how religion can be understood as a complex adaptive system. I will begin by describing the building blocks of religious systems. Then I will outline the feedback processes that constitute the religious system. This will be followed by a discussion of some implications of this systemic approach and why the religious system is best understood as a complex adaptive system.

2 Religions as Systems

I have asserted that religions are systems, but I am not alone in making such a claim. Two of the most influential anthropologists to study religion in the last 50 years, Clifford Geertz and Roy Rappaport, both approached religion as a system, although they did so in very different ways. One of Geertz's most celebrated articles, "Religion as a Cultural System" (1967/1973), embeds the study of religion in the nexus of a hermeneutic approach to culture, whereas Rappaport's magnum opus, *Ritual and Religion in the Making of Humanity* (1999), describes religion as a cybernetic system.

Despite the unabated influence of both Geertz and Rappaport's work, the academic study of religion has not taken a systemic turn. There are a few exceptions, however. For example, Czachesz (2014) develops a formal network model to explore the evolutionary dynamics of religious systems. His model relies on the interrelationship between religious beliefs, such as toward a god or spirit, and religious artifacts, including texts and ritual objects. Cho and Squier (2013) cautiously explore the merits of recognizing religions as complex systems, most notably the facilitation of cross-cultural comparisons. They are at least partially motivated by concerns of reductionism in the scientific study of religion (Cho and Squier 2008).

Notwithstanding these efforts to advance a theoretical foundation for a systemic approach, most religious studies scholars remain highly suspicious of attempts to generalize "religion" as a system, as Cho and Squier, as well as Czachesz, recognize. Nonetheless, advances in the study of complexity over the past several decades suggest that religion not only possesses systemic features but also can be characterized as a complex adaptive system. While the term complex adaptive system is defined elsewhere in this volume, it is worth clarifying how I have understood this term in my studies of religion, and how the term has entered anthropological discourse (Lansing 2003), since transdisciplinary terms can suffer shifts in meaning as they cross disciplinary boundaries. This is particularly true in the case of complexity studies; one of the few unanimities in the field appears to be that it is not (yet) a unified field (Mitchell 2009).

Systems, whether economic, political, or digestive, can be described as a set of interacting or interdependent elements that form an integrated whole (Von Bertalanffy 1972). "Complex" is also a term that carries colloquial meaning, but it holds a specific meaning in the context of complex adaptive systems. Miller and Page (2007: 9) explain that "[c]omplexity arises when the dependencies among the elements become important. In such a system, removing one such element destroys system behavior to an extent that goes well beyond what is embodied by the particular element that is removed. . . . Complicated worlds are reducible, whereas complex ones are not." Lastly, complex adaptive systems are "adaptive" in the sense that they are flexible and they respond successfully – in terms of the system's survival – to local social and ecological conditions.

Yet trying to explain what complex adaptive systems are by defining the words that constitute its taxonomic label is not sufficient and, in fact, highlights a key characteristic of actual complex adaptive systems: they are more than the sum of their parts (Holland 1998; Kauffman 1995). Complex adaptive systems possess a number of defining features; I describe these below and discuss how they are manifest within religious systems. First, however, I explore how religious systems are built.

2.1 *The Building Blocks of Religious Systems*

Holland (1995) lists “building blocks” as one of the seven basic characteristics that are common to all complex adaptive systems. As Holland explains, the component parts of any complex adaptive system are not arbitrary. Rather, complex adaptive systems consist of categories of elements that combine to create the system. The building block mechanism, that is, the combining of elements to create a system, inevitably generates astonishing variation. Holland illustrates this variation by considering the construction of faces. The building blocks of faces are features such as noses, ears, mouths, eyes, hair, cheeks, foreheads, and chins. Within each of these building block categories, there is variation, such as size, shape, and color: large oval green eyes, long wavy blonde hair, broad angular brown chin, and so forth. Using this variation, an almost limitless number of unique faces can be built simply by combining facial building blocks.

Religious systems also exemplify remarkable diversity, yet underlying all of this diversity is a set of recurring core features. Religious systems typically maintain eight building blocks: authority, meaning, moral obligation, myth, ritual, sacred, supernatural agents, and taboo. Each of these building blocks is most usefully conceived of as a unique category that may have an independent phylogenetic history, but within religious systems, they are inherently interconnected to the other building blocks within the system. Other features of religion are common, such as music, spirit possession, afterlife beliefs, prophecy, superstition, and pilgrimage, but they are not *essential* to the working of the religious system; rather, they are better understood as secondary forms of one of the essential building blocks identified above.

Here I describe the religious system’s building block categories.

Ritual Rappaport defines ritual as “the performance of more or less invariant sequences of formal acts and utterances not entirely encoded by the performers” (1999: 24). One of the most obvious aspects of ritual is that it requires human bodies; it is a physical action (Rappaport 1979). This banal observation turns out to be critically important, as will be evident below. Without performance, there is no ritual; unlike myth, for example, rituals are dead if they only exist in books or memories. Rappaport’s definition, like most definitions of ritual (e.g., Smith 1979; Turner 1969), recognizes the formality of ritual in the sense that rituals are

typically stylized, repetitive, and stereotyped. This formality distinguishes ritual from ordinary behaviors. Norms surrounding ritual generally define the appropriate times and places of performance. And rituals, of course, vary considerably in their intensity and pageantry (Whitehouse 2004); singing from the psalter on a Sunday morning and diving into a partially frozen lake to retrieve a cross are both religious rituals. As I will discuss below, rituals are the central building block of religious systems.

Taboo Taboos are often conceived of as anti-rituals. That is, whereas rituals must be performed, taboos restrict behaviors. Religions maintain taboos on countless activities, including the consumption of food and drink, social relationships, sex, smoking, gambling, wearing jewelry, exposing certain body parts, types of work, and so on. Some taboos are always in effect, such as Mormon prohibitions on smoking or Muslim bans on pork, but many taboos are temporally regulated, such as Catholic meat consumption during Lent. Taboos are effective at creating boundaries between populations, often limiting the types of social engagements that are possible (Douglas 1966).

Authority Religious systems generally have leaders or authority figures who possess particular power and influence within a community. These authorities include priests, prophets, gurus, magicians, shamans, imams, rabbis, ministers, seers, sorcerers, and witches. It is worth emphasizing that each of these authorities have distinct roles and functions within their respective communities. Yet such individuals similarly gain and maintain their authority through access to specialized knowledge and/or specialized access to supernatural beings and the worlds these beings inhabit. Often, individuals rise to prominence as a religious authority because of their charisma and oratory skills (Weber 1947). While some religious leaders, such as the pope, command considerable authority, others such as a synagogue president lead primarily by following the will of the community.

Myth Myths within religious systems serve to provide a contextual narrative for many of the other building blocks of religious systems. For example, myths often describe the origins and deeds of the gods, the reasons for certain rituals and taboos, and how religious leaders have been granted their authority. Myths also serve as explanations for phenomena, such as the sanctity of hills, rivers, and cities, the creation and history of a people, and the justifications for specific moral obligations. However, myths do not offer logical, or what might be described as scientific, explanations (Lévi-Strauss 1964/1994). Myths are lived explanations. They are better understood as one of the fundamental forms of religious discourse, if not the fundamental form. Indeed, communities often define themselves by the myths they share, and divergences in narratives often demarcate the fissure point between religious groups, such as the differing narratives of Jesus among the Abrahamic religions. Myths not only inform group boundaries and identity, they are of course entertaining, both frightening and alarming, and even humorous, such as trickster tales (Radin 1956/1972). For many, religious myths provide a window into what it means to be human.

Sacred Durkheim (1912/1995) famously distinguished between the sacred, that which is set apart, and the profane, that which is mundane. As many anthropologists have remarked (Alcorta and Sosis 2005; Rappaport 1999), sanctity is not discovered through encounter but rather created through ritual. Since ritual can sanctify just about anything, the range of sacred things is quite varied, including food items, books, land, clothing, weapons, animals, plants, people, ideas, symbols, words, and discourse. In the context of religious systems, to say that something is sacred is to suggest that it has particular emotional valence for individuals living within that system.

Supernatural Agent Supernatural agents are beings that exist and operate outside of physical reality, although they typically have impacts on the physical world. They are agents in the sense that they are ascribed actions and motives for those actions (Purzycki et al. 2012). The term “supernatural” itself is contested in the religious studies literature because many cultures do not perceive their gods, spirits, ghosts, demons, angels, and assorted beings as supernatural at all. Rather, these beings are perceived as a natural part of their social and physical landscape (Klass 1995). The concept of the supernatural, these scholars correctly argue, is a western concept, and when we impose it on non-Western cultures, we fail to understand how non-Westerners experience their religious worlds. Westerners often relate to their supernatural agents through what is described as “belief” or “faith.” Such a relationship to supernatural agents, though, is quite foreign to many of the small indigenous populations that anthropologists have studied, as well as many historical populations (Kugel 2017; Smith 1998). Nonetheless, while I appreciate that individuals within such populations might not conceive of particular beings as supernatural, I employ the term supernatural agents to describe a building block category because it offers a useful analytic position – an etic perspective – that distinguishes these agents from living beings (humans and animals), as well as fictional characters that populate contemporary entertainment genres.

Moral Obligation Anthropologists have long pointed out that religious systems and moral systems that are concerned with social ethics are generally distinct in traditional societies. It is only after the rise of domestication and intensive agriculture, and the associated sedentary lifestyle, that an indelible link between religious systems and social ethics emerges. Nonetheless, even in traditional foraging societies in which moral prohibitions such as sexual infidelity, theft, and murder are not supported through religious sanctions (i.e., they are immoral behaviors, but there are no priests or holy books that give such prohibitions authority), moral obligation is often established through religious systems, particularly through ritual (Kiper and Sosis 2014). Rappaport (1999: 132) suggests that breach of obligation may be “one of the few, if not, indeed, the only act that is always and everywhere held to be immoral.” In short, Rappaport argues that ritual performances establish obligations to behave according to the moral values explicitly or implicitly encoded in the rituals.

Meaning Religious systems not only offer explanations for the existence of humanity and the existence of particular communities, they offer a purpose for this existence. The comprehensiveness of religious systems – their ability to inform every aspect of an individual’s life – enables them to generate meaning for individuals. Religious systems work to keep nihilism at bay, and they enable adherents to make sense of their lives and give it purpose. Religious meanings range from fixing society through social justice to seeking individual salvation to preparing the world for the messiah. When religious systems are functioning optimally, religious meanings powerfully organize lives and establish order within communities (e.g., Levine 2003).

Why have these eight features served as building blocks for religious systems? To adequately answer this question, we would need a phylogenetic account of the emergence of the religious system, and unfortunately, our understanding of religion as a complex adaptive system is not yet developed enough to pursue such an analysis. Nonetheless, we do know enough to recognize that like all complex adaptive systems (Miller and Page 2007), the elimination of one of the religious system’s building blocks would result in either a collapse or transformation of the system into something else. Remove one of the building blocks, and the adaptive functionality of the religious system will be compromised. A religious system that lacks organization (authority), fails to impart significance (meaning), forsakes ceremonial activity (ritual), maintains no limits on activity (taboo), is unable to sanctify anything (sacred), offers no beings capable of transcending the natural world (supernatural agents), does not establish social commitments (moral obligation), or provides narratives that can link all these elements together into an explanatory framework (myth) will ultimately falter or transform into another social institution. Notably, religious systems are impressively resistant to the elimination of one of their core building blocks, as the persistence of supernatural elements within Buddhist cultures and Jewish Reconstructionist congregations attest.

Holland (2012) distinguishes between two types of building blocks: generators and conglomerates. The imperviousness and essentialness of the religious system’s building blocks suggest that they are generators. Generators do not change over their life course, and they behave consistently in similar contexts. Over their existence, they fit together with other generators in the same way and follow the same set of fixed rules in their reaction with other generators. Conglomerates, on the other hand, are building blocks that do change over their lifespan, sometimes dividing to produce other building blocks or adjusting to compensate for the loss of another building block. For example, the brain’s ability to self-repair through rewiring or taking over the functions of damaged areas suggests that the brain is built on conglomerate building blocks (Holland 2012: 112). It is possible that some of the religious system’s building blocks should be conceived as conglomerates, but this is an area that needs further investigation. In social environments where governments seek to eliminate specific building blocks of religious systems, the conditions might provide a natural experiment in which this possibility could be explored.

A few further comments concerning the religious system's building blocks are necessary. First, the building blocks identified above are likely universal across religious systems, but they are not building blocks because of their universality; there are other universal features of religions that are not core building blocks (e.g., symbolization, the creation of alternative worlds). Rather, these features are building blocks because they each appear to play a distinct and integrative role within religious systems. Second, and related to the first point, the identification of these eight core features is based on our understanding of how religious systems work. In other words, religious systems appear to function in particular ways and exhibit specific structural features, as I will describe below. Third and relatedly, while some common features of religion, such as pilgrimage, altered states of consciousness, spirit possession and so forth, are best depicted as falling within one of eight building block categories (e.g., altered states of consciousness are achieved through ritual), some religious systems may develop such that secondary features become building blocks. For example, the centrality of the peyote hunt among the Huichol Indians of northern Mexico (Myerhoff 1974) may suggest that pilgrimage is a building block of this particular religious system; without the pilgrimage for peyote, the system would likely collapse. The characterization of religious systems that I describe below depicts how most religious systems generally function, but as just noted, there are undoubtedly exceptions to these generalizations.

Our understanding of how the religious system's building blocks are put together is rudimentary, but we can make a few observations with some confidence. The adhesive holding the building blocks together is language. Indeed, the religious system is inconceivable without language; discourse serves to indicate the moral obligations conveyed in ritual performance, describe unseen supernatural agents, articulate prohibited behaviors, reveal myths, and so on.

While language undoubtedly serves to connect the religious system's building blocks, there appear to be inherent patterns through which these building blocks interrelate. These patterns likely constitute a grammar (Bulbulia 2012), and it is the ongoing task of evolutionary and cognitive researchers studying religion to uncover these grammatical rules. This task, however, is genuinely challenging because of the nonlinear nature of the interactions between the building blocks. As Holland (2012) points out, standard statistical observations will not suffice to uncover the rules interconnecting building blocks for any complex adaptive system.

Nonetheless, evolutionary and cognitive researchers have offered various theories that provide insights into the possible rules regulating relations between religion's building blocks. For example, the Modes Theory of Religion provides a useful framework for understanding the mechanisms that enable rituals to create meaning, and significantly, how variation in the frequency of ritual performance is related to variation in the formation of meaning (Whitehouse 2004). Likewise, Cronk's (1994) theory of signal manipulation provides a powerful explanation of how religious authorities employ ritual for means of exploitation (also see Watts et al. 2017). Sacred values research (Ginges et al. 2007; Tetlock 2003), offering another example, highlights the relationship between the sacred-profane distinction and taboo. Other theories, such as supernatural punishment theory (Johnson 2016;

Schloss and Murray 2011), signaling theory (Irons 2001; Bulbulia and Sosis 2011), MCI theory (Purzycki and Willard 2016), hazard precaution system theory (Lienard and Boyer 2006), and ritual form theory (McCauley and Lawson 2002), offer further insights about how all the building blocks within religious systems interrelate.

We are now in a position to provide a general outline of the structure of religious systems and how they work, even if our understanding of the how religion’s building blocks interact remains limited. We presently turn to this outline.

2.2 The Structure of Religious Systems

Figure 1 depicts a general illustration of the structure of religious systems. Religious systems begin with a group of socially engaged individuals. Individuals are agents of the model, and they can enter as well as depart from the group. Like all communities, the group is influenced by external factors including the social, political, economic, ecological, and religious environment in which the group is situated. Notably, however, religious groups are not simply influenced by their external conditions, they actively shape them (Bulbulia 2012; Purzycki and Sosis 2013). These external factors, as well as the internal social dynamics of the group, motivate human action

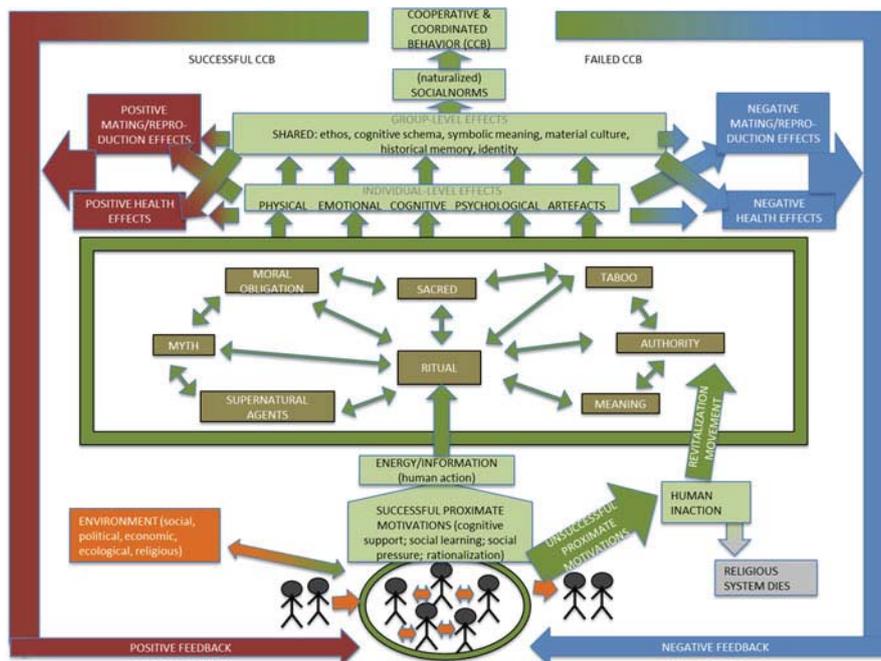


Fig. 1 The religious system

in the form of ritual behavior. Like all systems, religious systems require energy to function. Energy is introduced into the religious system through human action in the form of ritual. Ritual behavior contains energy, as well as social information, that enters the religious system. All systems transform energy; likewise, the religious system transforms the energy and information of human ritual behaviors into human cooperative and coordinated behaviors.

Since ritual is a physical performance, it may be self-evident that it carries energy; however, the information carried by ritual is less obvious. Ritual, as Rappaport (1999) explains, carries two types of information: indexical and canonical. Indexical information refers to messages that reveal the current state of the performer. For example, consider prayer. How loudly one prays or how vigorously one gesticulates can indicate the enthusiasm of the reciter, whereas one who prays with a scowl or teenage eye-roll on their face, or mumbles through their prayers, suggests a less enthusiastic endorsement of Sunday morning in the pews. Rituals also contain information about the past and future; indeed, rituals often appear enduring or even eternal to performers. This information is known as canonical, and it is often (but not always) contained in the verbal part of the ritual (Rappaport's "utterances" from the definition above). Continuing the example of prayer, the actual words being recited in prayer are canonical information. Moral codes are typically embedded, implicitly or explicitly, in ritual's canonical information.

How does human action in the form of ritual behaviors emerge from social groups? The proximate motivations are likely to be diverse and socioecologically vary. Fortunately, to appreciate how religious systems operate, we do not have to fully apprehend this process, although this is an important area for future work. We do know that rituals spontaneously emerge when communities are under threat. The ethnographic literature on cargo cults (e.g., Whitehouse 1995; Worsley 1957) offers abundant examples, and ethnographers have also detailed ritual practices that have emerged during times of war, such as psalm recitation (Sosis 2007; Sosis and Handwerker 2011). But it is clear that "community threat" is just one avenue through which ritual behaviors arise; new technologies, social movements, ecological changes, and demographic factors are among the many potential avenues that need to be further explored.

While we await future work that examines these external forces, it is important to recognize that the structures of rituals themselves play a role in their emergence. Specifically, successful ritual behaviors, that is, those that are performed and passed on to future generations, require cognitive support. Humans have implicit understandings of how rituals are supposed to work (Barrett and Lawson 2001; McCauley and Lawson 2002), and it is likely that rituals that are successfully motivated (i.e., brought to life) are those that are consistent with these implicit understandings. Put simply, some rituals are more compelling than others; those rituals that take a form that is congruent with cognitive expectations are likely to be more compelling than rituals that are more difficult to mentally process.

It is useful to distinguish between proximate motivations that can explain the emergence of ritual behaviors within a group from proximate motivations for continuing ritual behaviors that have previously stabilized within a community.

Mechanisms for the continuance of ritual behaviors include social learning (Henrich 2009), social pressure (Sosis 2003), and rationalizations about the efficacy of the ritual behaviors (Sosis and Handwerker 2011). Significantly, there appear to be critical developmental windows that facilitate the generational transmission of ritual knowledge (Alcorta and Sosis 2005; Finkel et al. 2010).

It is somewhat misleading to describe energy entering religious systems in the form of ritual behavior, because in fact ritual only manifests its full character through its interactions with other elements within the system. More accurately, human intentions and motivations enter the system and are transformed into ritual action through their interactions with other elements of the system. Subsequent inputs into the system take the form of the behavior transformed into religious ritual. Once energy enters the religious system through ritual behaviors, the elements that constitute the system interact with ritual behavior in feedback loops. Within religious systems, for example, ritual behaviors become associated with supernatural agents. Supernatural agents can take on various roles in ritual performance, such as the recipient of sacrificed food or the target of petitionary prayers. But whether supernatural agents are seen as receivers, creators, or enforcers of a ritual performance, once such agents become linked to a ritual, desires to please or appease the agents can proximally motivate the ritual performance. Indeed, the human action that emerges from the social group that provides the seeds of the system will be transformed into what we recognize as religious ritual once it interacts and incorporates the elements of the religious system.

The interaction of the religious system's core building blocks results in five primary individual-level effects: physiological, emotional, cognitive, neurological, and technological effects. The first four are internal responses of ritual performers. These responses span the entire gamut of human experience and are likely to vary significantly depending on whether the base rituals are dysphoric, such as Hindu fire walking (Power 2017), or euphoric, such as Sufi dancing (Trimingham 1971). In addition to these internal effects on individuals, the religious system also produces a primary external effect, or what can be considered an extended phenotype (see Purzycki and Sosis 2013), in the form of ritual objects. These artifacts include masks, mats, beads, pipes, attire, and countless other items fashioned by individuals immersed in their religious system.

These primary individual-level effects yield various group-level effects. Specifically, group-level effects include shared cognitive schema, ethos, symbolic meaning, material culture, historical memory, and group identity. Group-level effects are an emergent property of the religious system, and they can powerfully shape individual lives. Indeed, group-level effects produce societal order by creating structured and stable social worlds – often fantastically imaginative – that individuals inhabit and navigate. They are also generally the most salient features of religious systems and why religions are typically characterized as a collective phenomenon. These effects also give form to the initial population, providing the basis for sustained communal engagement.

2.3 *The Emergence of Social Norms in Religious Systems*

What emerges from these group-level effects are social norms; specifically, expectations and patterns of behavior that characterize communities. This is no small matter. Humans are able to conceive of alternative ways of engaging, understanding, and organizing life. Consequently, our social norms – that is, the way we pattern our lives – are always at risk of modification (Seligman and Weller 2012). Rappaport (1999) argues that this potential instability is minimized because our social norms become internalized and naturalized. One of the extraordinary features of human experience is that individuals view the norms in which they are entwined as a natural part of their existence (Berger 1967). Indeed, it is only when one is in tension with societal norms, such as facing away from an elevator door, that norms feel unusual or extraordinary.

Rappaport (1999) suggests that ritual plays a key role in the emergence of social norms from religious systems. Let us consider his argument. Rappaport observes that ritual's inherent structure is binary; one either performs a ritual or not. He maintains that while ritual behaviors appear to be shrouded in mystery, they are deliberate and their message to others is clear: participation in a ritual performance indexically signals acceptance of (and not necessarily belief in) the moral values encoded in the ritual. Participation, therefore, always carries obligations, and participants can be held accountable if these obligations are compromised. Lovers can be unfaithful, but adultery can be committed only after the marriage ceremony. Notably, flipping the correspondence theory of truth on its head, when the world does not conform to the moral order encoded in rituals, it is not the ritual that is wrong, but rather the world that needs to be adjusted.

As many anthropologists have emphasized, including Rappaport, the sacred is not discovered, but rather it is created through ritual. Sanctity emerges from the structure of ritual itself via at least two pathways. First, some rituals can evoke numinous experiences. The power of these experiences, which are undeniable to those who experience them (e.g., D'Aquili et al. 1979), make the discursive aspects of ritual unquestionable, that is sacred. Second, rituals consist of behavioral and discursive components. Rappaport (1999) describes the latter as invariant. Again, consider prayer, which consists of bodily movements as well as words. While the intensity of bodily movements, including how loudly prayers are recited, can vary across performers, what is recited (i.e., the canonical messages) is largely invariant. Canonical messages are not encoded by the performer (those sitting in the pews did not write the Psalms), and all performers utter the same words; therefore, this verbal aspect of ritual lacks information (e.g., Bloch 1974). But, it is argued that the meaning of the "informationlessness" that emerges from canonical invariance is certainty, which is understood to be unquestionable and true (Wallace 1966). Consequently, the moral messages carried by ritual seem correct, the arbitrariness of norms is transformed to necessity, and these norms seem natural and continuous with the physical world (Rappaport 1999).

While rituals create and support religious systems, rituals also produce other social constructions such as governments, kin networks, sports teams, and libraries. In other words, rituals spawn many systems; our focus here specifically on religious systems should not obscure the role that these other systems play in the manifestation of social life.

Ritual, sometimes within religious systems and sometimes in other systems, provides the stable grounding of social institutions. While not all institutions or their products, such as collective norms, are directly associated with ritual performance, social institutions are interlocking (e.g., consider how libraries systems are connected to monetary, educational, governmental, and other systems), and it appears that all foundational institutions (e.g., governments, legal systems) engender and sustain rituals. Indeed, this may be one of ritual's defining features. It is plausible that rituals inevitably emerge in such institutions because these physical acts provide the sanctity and grounding for our abstract construction of social reality. Rappaport (1999), consequently, sees ritual as the basic social act; ritual provides the source for the naturalization of social norms, and thus, he maintains that social life would not be possible without ritual performance. Ritual, as Seligman and Weller (2012) note, does not eliminate the ambiguities of social life, but it does enable us to live with this ambiguity.

2.4 Generating Cooperation and Coordination

While religious systems generate diverse social norms through ritual, the norms that sustain religious systems involve community-level cooperation and coordination. The cooperative and coordinated behaviors that are produced via these norms are, in evolutionary terms, the ultimate goals of religious systems. The success of religious systems in motivating cooperative and coordinated behaviors goes a long way toward explaining the emergence and perdurance of this complicated social institution.

The energetic output of religious systems, therefore, is cooperative and coordinated behavior. It is worth bearing in mind that the religious system is a stunningly convoluted way to produce such behavioral responses. Other social organisms have devised ways of achieving collective goals that are less complicated and mysterious. Selection, however, operates on available traits, and the religious system was built on the existing cognitive and behavioral foundation. Also, human language has necessitated complex solutions for sustaining cooperation and coordination. As Rappaport (1999) observes, the symbolic nature of language means there is always the possibility of deceit and lying since the relationships between signs and their significata are arbitrary. Thus, ultimately, actions (i.e., rituals) speak louder than words.

The religious system is cybernetic in the sense that feedback is inherent to its structure. Successful cooperation and coordination supports the group through the successful acquisition of energy, which feeds back into the system. Unsuccessful

cooperation and coordination also feed back into the group, and this lack of energetic input informs the group of failure and warns them about impending resource challenges. In addition to these energetic feedbacks, information about health, mating, and reproductive effects also feed back into the group, informing them about group vitality and offering proximate cues about the value of engaging in ritual behavior.

This information about health, mating, and reproduction emerges from individual- and group-level effects. The individual- and group-level effects that impact health can potentially be positive, as numerous studies on the health benefits of religion attest (Koenig et al. 2012). But they can also be negative as many rituals are dangerous, including subincision and scarification ceremonies in unhygienic environments (Hogbin 1970), ritual club fights (Hill and Hurtado 1996), and fire walking (Power 2017). And some religious beliefs can lead to mental instability (e.g., Luhrmann 2012). Moreover, both individual- and group-level effects can impact mating and reproduction, again both positively and negatively. Religions are associated with some of the highest fertility rates in the world (Kaufmann 2010; Shaver 2017), as well as the lowest (e.g., celibate monks, Shakers, etc.).

Within religious systems, when the balance of feedback is positive, individuals perform ritual behaviors, which feed the system with the necessary energy it needs to be sustained. However, when the balance of feedback is negative, proximate factors will not motivate ritual behavior, which will drive the system down one of two possible pathways. If conditions warrant, the group will undergo a religious revitalization (Heimola 2012; Wallace 1966). This will generally require an individual (or group of individuals) who emerges as an inspirational authority that can reinvigorate the group and motivate ritual action. Without the emergence of such a figure, the religious system is likely to die, which has been the fate of the majority of religious systems that have existed in human history. Obviously most religious systems spend much of their existence fluctuating between periods of success, stasis, failure, and revitalization. But ultimately, religious systems either die or transform beyond the recognition of the old system.

2.5 Adaptability of Religious Systems

Religion's ability to change, that is, its ability to adapt, turns out to be one of its most extraordinary, and most misunderstood, features. Religious claims are rarely stagnant or offer permanent truths about the world; they are flexible and respond effectively to changing socioeconomic and ecological conditions (Alcorta and Sosis 2005; Purzycki and Sosis 2009; Sosis 2009). Religions are adaptive systems that are not only responsive to changing conditions, but they are often instrumental in facilitating social change, such as the Ghost Dances among the Sioux (Mooney 1965) and Pawnee (Lesser 1978) and Black Churches in the Civil Rights Movement (Billingsley 1999).

If religions are responsive to changing circumstances, why do religions often appear to be so resistant to change? Why is religion often viewed as a conservative social force? One of the remarkable features of religion is its ability to adapt to local environmental conditions while adherents experience partaking in an eternally consistent and changeless tradition. Rappaport (1999) argues that religion achieves this through a hierarchy of religious discourse, for there is an inverse relationship between the material specificity of a religious claim and the durability of the claim. Religious ideas are hierarchically organized within communities, and at the apex of a community's conceptual hierarchy is what Rappaport refers to as ultimate sacred postulates, such as the *Shahada*, *Shema*, or *Vandana Ti-sarana* for Muslim, Jewish, and Buddhist communities, respectively. These ultimate sacred postulates lack material specificity and are highly resistant to change. However, below ultimate sacred postulates in the religious hierarchy are various cosmological axioms, ritual proscriptions, commandments, directives, social rules, and other religious assertions that do experience varying levels of change, depending on their material specificity.

While the rules of religions change throughout time, those who experience such adjustments consider them as an intensification of their own religious acceptance (Rappaport 1999). Religions rarely invalidate the old completely: change occurs by adding to previous practices and beliefs and also by elaborating upon them, while other beliefs and practices slip away unnoticed. Once sacralization is internalized, it is indeed very difficult to convince adherents that something consecrated is no longer holy. Hence, when undergoing change, religions often retain the most sacralized elements and augment them. For example, Jewish prayers are part of the Catholic Mass and when proselytizing to indigenous populations, missionaries often retain the dates of indigenous ritual celebrations and tolerate the continued commitment to indigenous ancestral spirits (e.g., Shaver 2015). Change for adherents therefore is not experienced as something radically new. It is rather experienced as an increased acceptance of eternal and personally relevant truths that, for the practitioner, have always been part of their religious tradition.

It is important to appreciate that sacred texts such as the Bible, Koran, or Bhagavad-Gita do not impede the ability of religions to adapt. Intuitively, it may seem that once sacred texts become an essential part of a religious system, as they are in contemporary world religions, that the permanence of these texts would make religions more inflexible. In fact, it is a testament (forgive the pun) to the adaptability of religious systems that textual resources often facilitate change.

Religious texts that endure do so because they are open to multiple literary interpretations. They tend to make use of metaphor and poetry that engage subconscious processes of personal significance and create contextual meaning. As a result, each new generation reinterprets religious texts in relation to their own meaningful experiences, thereby keeping them living, relevant, and fresh. Past interpretations are not necessarily rejected per se, but are instead transformed or ignored by the community. They nonetheless remain available should cultural change make their message relevant again. Indeed, the sacred writings of contemporary religious

traditions are vast repositories that leaders draw upon, emphasizing aspects that are socially and politically expedient, and disregarding those that are not. Though religious radicals often revive past interpretations to justify their radicalization and violence (Sosis et al. 2012), use of these latent textual resources is not always so contrived and manipulative. For example, the writings of twelfth-century condemned heretic, Peter Abelard, were largely forgotten until his ecumenical voice was “rediscovered” in the nineteenth century, when his writings received a more welcome reception than they did during his lifetime (Armstrong 1993; Carroll 2001).

While religious texts do not inherently impede the ability of religion to adapt, religions are at risk of over-sanctifying texts and other discourse. When religions sanctify – that is, make unquestionable – discourse that is materially specific, it renders the religious system maladaptive. If low-level materially specific discourse, such as social rules about homosexual marriage or the driving of cars by women, is highly sanctified, it limits the religious system’s ability to respond adaptively to changing socioecological conditions. These points articulate well with the observations of complexity theorists that complex adaptive systems exist on the edge of chaos (Kauffman 1995). Complex adaptive systems that are too ordered become inflexible, like fundamentalist religions. On the other hand, complex adaptive systems that are too chaotic are unable to gain traction within an environment. Likewise, religious systems without rules and expectations will not endure because the boundaries of such communities will remain undefined.

One last point is worth emphasizing about the adaptability of religious systems: adaptation is local. This is a source of confusion when discussing religions because we use labels such as Hinduism, Islam, Catholicism, and so forth to describe what we imagine are particular religions. But religious systems are local affairs, and therefore, the taxonomic labels that we ascribe to religions actually consist of multiple and often diverse religious systems. Religious systems that fall under the same taxonomic label are linked in the minds and even actions of those who identify with the label. These linked systems, in other words, are part of the environmental input that impacts individuals within a system. Interestingly, complexity scientists recognize that taxonomic labels can influence system dynamics (Holland 1992, 2012). Religious taxonomic labels are often contested with significant implications for human welfare and lives, especially since the rise of nation states (Seeman 2010). The important point here is that the broad taxonomic labels, particularly of major world religions, should not be confused with religious systems; religious systems are locally defined and they locally adapt. World religions consist of many varied localized religious systems. This hierarchical structure is what complexity theorists would anticipate. Holland (2012: 110), for instance, comments that in “most complex adaptive systems, building blocks at one level of complexity are combined to get building blocks for structures at a higher level of complexity.”

3 Primary Features of Religions as Complex Adaptive Systems

In addition to building block mechanisms, complexity scholars have delineated many features that are deemed essential to all complex adaptive systems. Here I list some of these features and briefly discuss how they are manifest in religious systems.

Emergence Emergence is a difficult and sometimes heated topic among complexity scientists (see Corning 2002; Deacon 2010; Holland 1998). As is often the case, competing definitions have inflamed debate and complicated rather than clarified matters. Nonetheless, most scholars would agree that emergence is exhibited where properties result from the interactions of a system's components that are not in evidence among the components themselves. Emergence implies that phenomena cannot be explained from linear interactions among the system's components.

Religious systems exhibit emergent properties, including group identities, shared symbolic meanings, and other group-level features discussed above. When the core features of religious systems coalesce, social phenomena are created, specifically group-level properties, which are not in evidence independently among religion's core elements. For example, a child's belief that ghosts reside in her closet does not produce shared symbolic meanings, but belief in ghosts embedded within an animist religious system, such as I encountered during ethnographic fieldwork in Micronesia (Sosis 2005; Spiro 1952), will generate many group-level effects.

The emergent nature of religious systems has significant implications for how we understand religious beliefs. The complex systems approach to understanding religion emphasizes that religious beliefs are not independent propositional claims about the world (Sosis and Kiper 2014a). Religious beliefs emerge from within a cultural system, and they must be understood within that system. In other words, religious belief, as an element of a larger religious system, cannot be analyzed independently of the system in which it is embedded. To do so is like evaluating a symphony when you can hear only one instrument. Moreover, similar to a symphony, religious systems have emergent properties, and thus religion cannot be reduced to independent propositional claims.

Interestingly, the emergent nature of religious beliefs, especially in relation to myth, is a point of potential agreement between some atheists and theologians. Atheist philosopher Daniel Dennett, for instance, argues that telling stories is fundamental to humanity. Notably, he writes "Our tales are spun, but for the most part we don't spin them; they spin us. Our human consciousness, and our narrative selfhood, is their product, not their source" (Dennett 1991: 418). Protestant theologian, Paul Tillich, would likely agree. For him religions employ myth "because symbolic expression alone is able to express the ultimate" (1957: 41). Myths are not history – and Tillich warns that mistaking myth for history is idolatrous – but myths remain powerful because they are able to transcend

themselves and express group values and identity (Mecklenburger 2012), a point in which Dennett would likely be in agreement.

One final point concerning emergence: because religions exhibit emergent properties, studying their building blocks independently as though they are not embedded within a religious system can result in misleading conclusions about religions. Since religions are complex and the result of nonlinear interactions of its building blocks, they simply cannot be broken down and easily reassembled. It is the interaction between components of the system that must be understood (Sosis 2009). We will return to this issue below.

Self-Organization Complex adaptive systems spontaneously self-organize, that is, they do not require top-down or bottom-up orchestration to develop; they emerge inherently from the interactions of the system's components. One of the fascinating characteristics of religious systems is that they seem to arise naturally wherever humans live as a community. And as countless commentators of communist China and Russia have remarked, they even arise in the face of social and political forces that are designed to prevent their emergence. Equally intriguing, secular groups who distance themselves from religious dogma nonetheless often adopt the features of religious systems, and some might be considered quasi-religious. Greek fraternities at US universities, for instance, often generate unverifiable mythic narratives, intense ritual routines, and unfalsifiable ideologies concerning "brotherhood" (Shaver et al. 2018; Sosis and Bressler 2003). Likewise, successful secular terrorists, similar to their religious counterparts, employ features of religion, such as emotionally evocative symbols, rituals, and myths (Sosis et al. 2012).

Self-organization does not imply a lack of hierarchical structure. While some complex adaptive systems, such as bird flocks, lack central organization, others, such as the nervous system, develop central controls. Religious systems appear to require hierarchical organization – notably, religious leaders in the form of priests, shamans, healers, gurus, prophets, and so forth emerge – despite countless attempts to build perfectly egalitarian religious communities.

Unconsciousness Constituent entities within complex adaptive systems are unconscious of the process of self-organization. The design of complex adaptive systems can appear to observers to be ingenious, such as the functioning of biological cells, but no intelligence is required among constituent entities, in this case, ribosomes, lysosomes, Golgi apparatus, and so forth. Moreover, constituent entities are often completely unaware of the entirety of the system; their information is limited to their local environment.

While religious systems self-organize without top-down or bottom-up orchestration, like most complex adaptive systems, the agents – i.e., humans – lack complete information about the workings of the systems they enliven. Their interactions, which result in the formation of religious systems, are generally not consciously aimed at creating religious systems. Indeed, one of the successful regulatory mechanisms of religious systems appears to be its ability to shelter agents (i.e., adherents) from the functioning and goals of the system itself. Accurate insight

into the workings of religious systems might actually be a destabilizing force; mythic narratives and supernatural rewards and punishments, reinforced through ritual routines, tend to be better motivators than mundane incentives.

Decentralization Complex adaptive systems typically lack central control. However, this does not mean that all constituent entities play an equal role in the emergence and functioning of a complex adaptive system. Indeed, as noted above, complex adaptive systems are often hierarchically organized and that seems to be the case for most religious systems. Importantly, complex adaptive systems that exhibit hierarchical organization maintain their structure despite the constant flow of agents through the system. Cells within the human body are ephemeral, firms succeed and fail within economic markets, and popes are chosen, and ultimately either resign or pass away, while the hierarchical structure of these respective systems endures.

Regulatory Mechanisms Complex adaptive systems require regulatory mechanisms that enable them to respond adaptively to changing environmental conditions. Our discussion of the hierarchy of religious discourse, above, describes one of the regulatory mechanisms that enable religious systems to adapt to changing environmental systems. Moreover, the nature of the feedback loops in religious systems is such that when a system is not producing cooperative and coordinated behavior, or group members experience negative health or reproductive impacts, this information effects the potential performance of ritual behaviors. Accordingly, the system itself will adjust by possibly revising rules, weaving new motivational myths, or even imagining novel supernatural worlds; otherwise the system will die.

Open Complex adaptive systems are open systems; that is, they have fuzzy (i.e., not well-defined) and porous (i.e., easily crossed by agents) boundaries. Religious groups, of course, vary in how open or closed they are (Wilson et al. 2017). Some religions proselytize and seek outside members, such as most forms of Christianity, whereas other religions, such as Judaism, discourage new members from joining. Further, individual mobility varies significantly across religious landscapes. For example, in the USA, where religions are experienced as free market commodities, there are much higher levels of denominational switching than in European countries where state-supported religious monopolies exist (Putnam and Campbell 2010). There are also considerable differences between world and indigenous religions in their openness; major world religions tend to be much more open. In many indigenous communities, the only way to join the religious community is to participate in the local initiation ritual; there are no anonymous members in distant lands (Whitehouse 2004).

Amplification of Random Fluctuations Positive feedback loops direct complex adaptive systems toward divergent evolutionary pathways; in other words, small random changes that are not necessarily adaptive responses to environmental conditions can result in substantial differences across systems. Because interactions among agents are nonlinear, as discussed above, small fluctuations in input can have considerable impacts on output. This of course has significant consequences for understanding religious systems. For example, Jewish communities that I have

visited in North America, South America, Europe, Africa, Middle East, and India exhibit extraordinary religious diversity. Their differences in food preferences, dress, greetings, language, styles of prayer, and so forth are a product of the local sociocultural environment. But how and why communities initially settled in a particular area is often the result of a fortuitous decision of a religious leader, a ship simply landing where the winds took it, myths of golden streets, and countless other random factors that are not adaptive responses to environmental conditions. Yet these factors result in astonishing differences between communities over time. Or consider religious holidays that mark a historical event. Jews, for instance, observe four minor fast days to commemorate tragedies in their history, or in one case a tragedy narrowly averted, but the dates themselves are the incidental consequence of history. Yet, once the fast days were canonized as part of the Jewish calendar, the shape and rhythm of the Jewish year and the lived experiences of Jews were altered. The amplification of random fluctuations suggests that researchers must be cautious when analyzing religious systems not to over-interpret their adaptive nature; adaptive responses are often built on random fluctuations.

History One implication of the amplification of random fluctuations for complex adaptive systems is that historical contingency is always partially responsible for present behavior. This means that historical analyses will play an important role in understanding any complex adaptive system, and religious systems are no exception. Indeed, it would be impossible to understand why any religion takes the form it does without understanding the historical factors that shaped the religion accordingly.

Unpredictability of Agents It is generally difficult to predict the behavior of specific agents in a complex adaptive system. Even when group-level behavioral patterns appear to stabilize, it is very difficult, if not impossible, to predict individuals' lives. For example, we can confidently anticipate a gathering of parishioners at a local church on Sunday morning, but even regular worshippers will fail to attend occasionally due to illness, travel, or mood, factors we are unlikely to foresee.

Disequilibrium One of the most interesting and significant features of complex adaptive systems is that they do not operate at equilibria conditions. This does not mean that they do not experience moments of stasis, but their responsiveness to changing environments keeps complex adaptive systems nearly in constant flux. The reason that this is so important is because it implies that religious systems are continuously evolving. This will strike some as extraordinary and even outlandish. But as discussed above, while religious systems give the impression to adherents and outsiders that they are eternal and stable, religious systems are in fact constantly adjusting to local socioecological conditions. As Bulbulia (2009) has astutely noted, a historical glance at any religion will reveal both surprising stability (e.g., the Lord's Prayer) and extensive change (e.g., the language in which it is recited).

3.1 Four Additional Features of Complex Adaptive Systems

One of the world's leading complexity theorists, computer scientist John Holland (1992), offers four additional features of complex adaptive systems. First, agents interact by sending signals and they interact simultaneously, which he terms parallelism. Second, agents are characterized by conditional action in that they respond to signals as if-then statements. Third, the regulatory mechanisms of complex adaptive systems are modular in the sense that groups of rules combine to form what we might think of as subroutines. These subroutines enable complex adaptive systems to deal with novel conditions. Fourth, not only do complex adaptive systems themselves adapt and evolve, but agents and constituent elements within these systems adapt and evolve as well.

There are several points to emphasize when considering how these features relate to religious systems. First, signaling theory offers a robust collection of models that have been rigorously applied to religion by economists, sociologists, biologists, psychologists, and anthropologists (see Bulbulia and Sosis 2011). However, this work has not yet recognized that religious signals lie at the core of the communication structure that enables religious systems to operate. Second, what Holland in the language of computer science refers to as subroutines is particularly important for understanding religious systems. Much of what cognitive and evolutionary researchers have been uncovering concerning the relationships between the religious system's core building blocks, such as Modes Theory and Supernatural Punishment Theory, are subroutines in Holland's terms. Moreover, the linkage of rules also occurs at the level of agent-agent interactions because religious rules are regularly tied together. In religious communities, there are expectations that if an individual follows one rule, there are other rules that are assumed to be obeyed as well. The Muslim who habitually prays five times each day but enjoys a ham sandwich after evening prayers will be eyed with suspicion, and notably, the prayers themselves, even if heartfelt, will be unlikely to serve as effective signals of one's commitment to the community. Third, not only do religious systems adapt, but the individuals who enliven such systems change and the core elements of religious systems change as well. It is indeed likely that the building blocks of religious systems have been transformed over time, lending support to the warning that anthropologists have long voiced about not generalizing across categories of religions, such as tribal, chiefdom, and contemporary world religions (Evans-Pritchard 1965). For instance, religious meaning differs considerably across these categories, and as Whitehouse (2004) observes, it is likely a function of variation in the frequency of ritual performance.

4 Discussion

Religious systems are clearly organic. The coalescence of various cognitive, neurological, behavioral, affective, and developmental aspects of humanity has resulted in self-sustaining and cross-culturally recurring systems in which individuals, interacting through signaling mechanisms, bring life to these systems. One of the most important lessons of the complex adaptive approach to religion, and vital messages of this chapter, is that altering one part of a complex adaptive system, such as a religious systems, has significant effects on other parts. Those effects, notably, are difficult to predict even for those most familiar with religious systems, including scholars and religious leaders. For example, sociologists Rodney Stark and Roger Finke (2000) have argued that when the Second Vatican Council in 1962 repealed many of the Catholic Church's prohibitions and reduced the level of strictness in the church, it had unforeseeable consequences. The Vatican Council was an attempt to regain the commitments of wavering Catholics, but it inadvertently initiated a decline in church attendance among American Catholics and reduced the overall enrollments in seminaries. In the late 1950s almost 75% of American Catholics were attending Mass weekly, but since the Vatican's actions, there has been a steady decline to the current rate below 35% (D'Antonio et al. 2007; Hadaway and Marler 2005). A similar reduction in commitment is associated with the purging of ritual obligations in Reform Judaism as well (Iannaccone 1994; Lazerwitz and Harrison 1979). Though many other instances could be referenced, what these two examples illustrate is that religions grow organically, and thus naïve tampering with them can result in unexpected changes, even stunted growth or collapse.

Most contemporary discussions of religion involve concerns about the rising, and what is perceived to be uncontrollable, geopolitical influence of religion today. The merit of any theory lies in its ability to explain current trends and by that measure the complex adaptive systems approach fares comparatively well. Understanding religions as complex adaptive systems underscores how external pressures that aim to change religions can sometimes result in dangerous consequences. For instance, religious radicalization, such as the emergence of the Muslim Brotherhood in Egypt, Turkey, and elsewhere, appears to have been a response to aggressive secular campaigns (Armstrong 2000; Ruthven 2004). Minimizing religious extremism in the future thus may require secularists to countenance religious traditions and design policies accordingly. This will not be easy, for even externally imposed changes that are intended to benefit religious communities can have long-term negative consequences. For example, on March 3, 1948, during a period of civil war prior to the Israeli War of Independence, Ben Gurion established a military exemption for yeshiva students. He presumably felt he was saving a cultural remnant of European Jewry that was otherwise headed toward extinction with the birth of the secular Israeli state (Efron 2003). As the yeshiva population has grown exponentially because of the extraordinary birth rates of Israeli Ultra-Orthodox Jews, not serving in the military has emerged as a costly signal of one's commitment to the community. For Jewish Israelis, not serving in the military is a stigma with

consequences in the labor market. But this stigma serves as a gatekeeper within the religious community: one way of demonstrating one's commitment is staying in yeshiva not just until the possibility of being drafted has passed due to age, but even several years after one is eligible for the draft (Berman 2000). As a result, Yeshiva students and their families are exceedingly poor because under the terms of their military exemption they are permitted only minimal employment. Due to their failure to recognize that the military exemption has been transformed into a religious commitment signal, the government has attempted to alleviate the financial plight of these yeshiva students by increasing their subsidies, but this has only exacerbated the problem (Berman 2009). By increasing payments to yeshiva students, the government has increased the amount of time yeshiva students must remain in the yeshiva to serve as an effective signal of commitment. In short, the government subsidies have effectively decreased the costs of the signal.

Complexity theorists acknowledge that because of the nonlinear dynamics of complex adaptive systems, it will be a challenge to develop a general theory of complex adaptive systems that will generate reliable predictions. However, these theorists also argue that such a pursuit is not hopeless. They emphasize, for example, that all complex adaptive systems exhibit lever points (Holland 1995). These are points in the system where small changes can have predictable system-wide effects. One obvious lever point in religious systems is ritual performance. As Atkinson and Whitehouse (2011) have shown, changes in a ritual's frequency and intensity have predictable consequences for the hierarchical structure of the ritual community as well as cognitive impacts on individual perceptions of local versus universal communities. Of course, likewise, eliminating a ritual entirely can have profound effects on a community. Tuzin (1997), for example, ethnographically documents how social dynamics among the Ilahita Arapesh were transformed following the demise of the central ritual cult known as the Tambaran. The secret male cult was eliminated when a revivalist movement overtook the Ilahita villages where Tuzin was conducting fieldwork. Fathers lost the respect and control of their sons, which had previously been secured by the brutal initiation rites of the Tambaran. Wives, who were left out of the Tambaran, now had social power that enabled them to dominate their husbands. Beyond social relations, work itself also completely changed. Garden work, especially yam cultivation, lost its meaning for Ilahita men; what was once an activity motivated by the possibility of pleasing the spirits and contributing to Tambaran feasts, now became drudgery for these men.

While ritual performance is clearly a lever point in religious systems, the examples discussed throughout this chapter suggest that our ability to anticipate changes at this lever point is limited. Religions are complex adaptive systems, and our understanding of them is incomplete. Like other systems in nature, religions are dynamic, emergent, and difficult to predict. By recognizing religions as complex adaptive systems, it is hoped that students, scholars, and policy-makers appreciate that if there are compelling reasons to control or reform religions, we currently have limited understanding of how to do so, and naïve policies seeking change are likely to have unintended consequences. This does not mean that societies are simply at

the mercy of religious exigencies, but it does suggest that effective engagements with religions will require an appreciation that they are dynamic complex systems, and all that this implies.

5 Conclusion

I began this chapter with a story, and I will end it with a story. While many people are aware of Yom Kippur, the Jewish day of atonement on which Jews fast (no food or water) for 25 hours, less well-known are the four minor fasts in the Jewish ritual cycle mentioned above: Tzom Gedaliah, Asarah b'Tevet, Shiva Asar b'Tammuz, and Ta'anit Esther. While conducting ethnographic fieldwork in Israel among Orthodox Jews, I asked a friend whether he observes these minor fasts, as I was aware that not all Orthodox Jews observe them. He responded that although these fasts did not hold much meaning for him (they commemorate various tragedies, or tragedies narrowly averted, in Jewish history), he did indeed observe the fasts. I asked him why and he responded that if he failed to do so the whole “thing” would unravel. I was slow in comprehending what he was saying so I asked him what he meant; what “thing” would unravel? His response: Judaism. He explained that Judaism was a complete package and that if you stopped doing one thing, then soon enough other religious obligations would be neglected and pretty soon, in his own words, everything would begin to unravel. I share this anecdote for my anthropological colleagues who would rightly be concerned that the complex adaptive system approach that I have outlined here fails to capture the experience of lived religion. That is a fair critique, although my goal here was to offer an explanatory model of religion rather than a phenomenological account. Nevertheless, as my friend described, many people see their religion as a system, and a complex one at that, even if they would not use the language of complexity studies to describe their religion. Although the complex adaptive system approach to religion is just in its infancy, one day it may offer an avenue for both etic and emic analyses of religion, fulfilling the elusive promise of a truly holistic anthropology.

Acknowledgments I thank the James Barnett Endowment for support and Michael Price, John Smart, and Connor Wood for helpful comments on an earlier draft of this chapter.

References

- Alcorta, C.S. and Sosis, R. 2005. Ritual, emotion, and sacred symbols: The evolution of religion as an adaptive complex. *Human Nature* 16:323–359.
- Alcorta, C.S. and Sosis, R. 2006. Why Ritual Works: A Rejection of the By-Product Hypothesis. *Behavioral and Brain Sciences* 29:613–614.
- Armstrong, K. 1993. *A History of God*. New York: Ballantine Books.
- Armstrong, K. 2000. *The Battle for God*. New York: Random House.

- Atkinson, Q.D., & Whitehouse, H. 2011. The cultural morphospace of ritual form: Examining modes of religiosity cross-culturally. *Evolution and Human Behavior*, 32:50–62.
- Barrett, J.L. and Lawson, E.T. 2001. Ritual intuitions: Cognitive contributions to judgments of ritual efficacy. *Journal of Cognition and Culture*, 1(2), 183–201.
- Berger, P. 1967. *The Sacred Canopy*. New York: Anchor Books.
- Berman, E. 2000. Sect, Subsidy and Sacrifice: An Economist's View of Ultra-Orthodox Jews. *Quarterly Journal of Economics* 115:905–953.
- Berman, E. 2009. *Radical, Religious and Violent*. Cambridge: MIT Press.
- Billingsley, A. 1999. *Mighty like a river: The Black church and social reform*. Oxford: Oxford University Press.
- Bloch, M. 1974. Symbols, song, dance and features of articulation: Is religion an extreme form of traditional authority? *European Journal of Sociology*, 15, 54–81.
- Bulbulia, J. 2009. Charismatic signalling. *Journal for the Study of Religion, Nature, Culture*, 3(4), 518–551.
- Bulbulia, J. 2012. Spreading order: religion, cooperative niche construction, and risky coordination problems. *Biology and Philosophy*, 27(1), 1–27.
- Bulbulia, J. and R. Sosis 2011. Signaling theory and the evolution of religions. *Religion* 413:363–388.
- Carroll, J. 2001. *Constantine's Sword*. Boston: Houghton Mifflin Co.
- Cho, F., & Squier, R.K. 2008. "He Blinded Me with Science": Science Chauvinism in the Study of Religion. *Journal of the American Academy of Religion*, 76(2):420–448.
- Cho, F., & Squier, R.K. 2013. Religion as a complex and dynamic system. *Journal of the American Academy of Religion*, 81:357–398.
- Coming, P. 2002. The re-emergence of "emergence": a venerable concept in search of a theory. *Complexity* 7(6):18–30.
- Cronk, L. 1994. Evolutionary Theories of Morality and the Manipulative Use of Signals. *Zygon* 29:81–101.
- Czachesz, I. 2014. The Evolutionary Dynamics of Religious Systems Laying the Foundations of a Network Model. *Origin of Religion, Cognition and Culture*, edited by A. Geertz and J. Sinding Jensen, pp. 98–120.
- D'Antonio, W.V., J.D. Davidson, D.R. Hoge, and M.L. Gautier 2007. *American Catholics Today: New Realities of their Faith and their Church*. New York: Rowman and Littlefield Publishers.
- D'Aquili, E.G., Laughlin, C.D. and McManus, J. 1979. *The spectrum of ritual*. New York: Columbia University Press.
- Deacon, T. 2010. *Incomplete Nature*. New York: Norton.
- Dennett, D. 1991. *Consciousness Explained*. Boston: Little, Brown & Co.
- Douglas, M. 1966. *Purity and danger: An analysis of concepts of pollution and taboo*. New York: Routledge.
- Durkheim, E. 1912/1995. *The Elementary Forms of Religious Life*. New York: Free Press.
- Efron, N.J. 2003. *Real Jews: Secular vs. Ultra-Orthodox and the Struggle for Jewish Identity in Israel*. New York: Basic Books.
- Evans-Pritchard, E. 1965. *Theories of primitive religion*. London: Oxford University Press.
- Finkel, D., P. Swartzwout, and R. Sosis. 2010. The Socio-Religious Brain: A Developmental Model. Eds. R. Dunbar, C. Gamble, J. Gowlett. *Proceedings of the British Academy* 158: 283–307.
- Geertz, C. 1967/1973. Religion as a cultural system. In *The Interpretation of Cultures*, pp. 87–125. New York: Basic Books.
- Ginges, J., Atran, S., Medin, D., and Shikaki, D. 2007. Sacred bounds on rational resolution of violent conflict. *Proceedings of the National Academy of Sciences*, 104, 7357–7360.
- Hadaway, C.K. and P.L. Marler 2005. How Many Americans Attend Worship Each Week? An Alternative Approach to Measurement. *Journal for the Scientific Study of Religion*. 44:307–322.
- Heimola, M. 2012. *Religious Rituals and Norms in the Making of Adaptive Systems*. Doctoral thesis, University of Helsinki.

- Henrich, J. 2009. The evolution of costly displays, cooperation and religion: Credibility enhancing displays and their implications for cultural evolution. *Evolution and Human Behavior*, 30, 244–260.
- Hill, K., and Hurtado, A.M. 1996. *Ache life history: The ecology and demography of a foraging people*. New York: Aldine de Gruyter.
- Hogbin, I. 1970. *The island of menstruating men: Religion in Wogeo, New Guinea*. London: Chandler Publishing.
- Holland, J.H. 1992. *Adaptation in Natural and Artificial Systems: An Introductory Analysis with Applications to Biology, Control and Artificial Intelligence*. Cambridge: MIT University Press.
- Holland, J.H. 1995. *Hidden Order: How Adaptation Builds Complexity*. New York: Addison-Wesley.
- Holland, J.H. 1998. *Emergence: From Chaos to Order*. Oxford: Oxford University Press.
- Holland, J.H. 2012. *Signals and boundaries: Building blocks for complex adaptive systems*. Cambridge: MIT Press.
- Iannaccone, L.R. 1994. Why strict churches are strong. *American Journal of Sociology* 99:1180–1211.
- Irons, W. 2001. Religion as a hard-to-fake sign of commitment. In R. Nesse (ed.), *Evolution and the capacity for commitment*, pp. 292–309. New York: Russell Sage Foundation.
- Johnson, D.D.P. 2016. *God is Watching You: How the Fear of God Makes Us Human*. Oxford: Oxford University Press.
- Kauffman, S. 1995. *At home in the universe: The search for the laws of self-organization and complexity*. Oxford: Oxford University Press.
- Kaufmann, E. 2010. *Shall the religious inherit the earth? Demography and politics in the twenty-first century*. London: Profile Books.
- Kiper, J. and Sosis, R. 2014. Moral intuitions and the religious system: an adaptationist account. *Philosophy, Theology, and Science* 1:172–199.
- Kiper, J. and Sosis, R. 2016. The Roots of Intergroup Conflict and the Co-option of the Religious System: An Evolutionary Perspective on Religious Terrorism. In *Oxford Handbook of Evolutionary Perspectives on Religion*, eds. J. Liddle and T. Shackelford. Oxford: Oxford University Press.
- Klass, M. 1995. *Ordered Universes: Approaches to the Anthropology of Religion*. Boulder: Westview Press.
- Koenig, H., King, D., and Carson, V.B. 2012. *Handbook of religion and health*. Oxford: Oxford University Press.
- Kugel, J. 2017. *The Great Shift*. New York: Houghton Mifflin Harcourt.
- Lansing, J.S. 2003. Complex adaptive systems. *Annual review of anthropology*, 32(1), 183–204.
- Lazerwitz, B. and M. Harrison 1979. American Jewish Denominations: a social and religious profile. *American Sociological Review* 44:656–66.
- Lesser, A. 1978. *The Pawnee ghost dance hand game: ghost dance revival and ethnic identity*. Madison: University of Wisconsin Press.
- Levine, S.W. 2003. *Mystics, mavericks, and merrymakers: An intimate journey among Hasidic girls*. New York: NYU Press.
- Lévi-Strauss, C. 1964/1994. *The raw and the cooked: Introduction to a science of mythology*. New York: Pimlico.
- Lienard, P. and Boyer, P. 2006. Whence collective rituals? A cultural selection model of ritualized behavior. *American Anthropologist*, 108(4), 814–827.
- Luhrmann, T.M. 2012. *When God talks back: Understanding the American evangelical relationship with God*. New York: Vintage.
- McCauley, R.N. and Lawson, E.T. 2002. *Bringing ritual to mind: Psychological foundations of cultural forms*. Cambridge: Cambridge University Press.
- Mecklenburger, R. 2012. *Our Religious Brains*. Woodstock, VT: Jewish Lights Publishing.
- Miller, J.H. and Page, S.E. 2007. *Complex Adaptive Systems: An Introduction to Computational Models of Social Life*. Princeton: Princeton University Press.
- Mitchell, M. 2009. *Complexity: A guided tour*. Oxford: Oxford University Press.

- Mooney, J. 1965. *The ghost-dance religion and the Sioux outbreak of 1890*. Chicago: University of Chicago Press.
- Myerhoff, B.G. 1974. *Peyote hunt: The sacred journey of the Huichol Indians*. Ithaca: Cornell Univ. Press.
- Power, E.A. 2017. Discerning devotion: Testing the signaling theory of religion. *Evolution and Human Behavior*, 38:82–91.
- Purzycki, B.G., Finkel, D.N., Shaver, J., Wales, N., Cohen, A.B., & Sosis, R. 2012. What does God know? Supernatural agents' access to socially strategic and non-strategic information. *Cognitive Science*, 36:846–869.
- Purzycki, B.G., Haque, O., and Sosis, R. 2014. Extending Evolutionary Accounts of Religion beyond the Mind: Religions as Adaptive Systems. In *Evolution, religion, and cognitive science: Critical and constructive essays*, eds. F. Watts and L. Turner, pp. 74–91. New York: Oxford University Press.
- Purzycki, B.G. and Sosis, R. 2009. The Religious System as Adaptive: Cognitive Flexibility, Public Displays, and Acceptance. in E. Voland and W. Schiefenhövel (eds), *The Biological Evolution of Religious Mind and Behavior*, pp. 243–56. New York: Springer Publishers.
- Purzycki, B.G. and Sosis, R. 2010. Religious Concepts as Necessary Components of the Adaptive Religious System, in U. Frey (ed), *Interdisciplinary Perspectives on Philosophy: Evolution and Religion*, pp. 37–59. Marburg, German: Tectum Verlag.
- Purzycki, B.G. and Sosis, R. 2011. Our Gods: Variation in Supernatural Minds, in *Essential Building Blocks of Human Nature*, ed. Ulrich Frey, C. Stormer, K.P. Willfuhr, pp. 77–93, New York: Springer.
- Purzycki, B.G. and Sosis, R. 2013. The extended religious phenotype and the adaptive coupling of ritual and belief. *Israel Journal of Ecology & Evolution*, 59(2): 99–108.
- Purzycki, B.G. and Willard, A. 2016. MCI Theory: A Critical Discussion. *Religion, Brain & Behavior*, 6(3): 207–248.
- Putnam, R.D. and Campbell, D.E. 2010. *American grace: How religion divides and unites us*. New York: Simon and Schuster.
- Radin, P. 1956/1972. *The trickster: a study in American Indian mythology*. New York: Schocken.
- Rappaport, R.A. 1979. The obvious aspects of ritual. In *Ecology, Meaning, and Religion*, pp. 173–221. Richmond, CA: North Atlantic Books.
- Rappaport, R.A. 1999. *Ritual and Religion in the Making of Humanity*. London: Cambridge Univ. Press.
- Ruthven, M. 2004. *Fundamentalism: The Search for Meaning*. Oxford: Oxford University Press.
- Schloss, J.P. and Murray, M.J. 2011. Evolutionary accounts of belief in supernatural punishment: A critical review. *Religion, Brain & Behavior*, 1(1):46–99.
- Seeman, D. 2010. *One people, one blood: Ethiopian-Israelis and the return to Judaism*. New Brunswick: Rutgers University Press.
- Seligman, A.B. and Weller, R.P. 2012. *Rethinking pluralism: Ritual, experience, and ambiguity*. Oxford University Press.
- Shaver, J. 2015. The evolution of stratification in Fijian ritual participation. *Religion, Brain & Behavior* 5(2):101–117.
- Shaver, J. 2017. Why and how do religious individuals, and some religious groups, achieve higher relative fertility? *Religion, Brain & Behavior*, 7(4), 324–327.
- Shaver, J., Divietro, S., Lang, M., and Sosis, R. 2018. *Costs do not explain trust among secular groups*. *Journal of Cognition and Culture* 18: 180–204.
- Shaver, J., B. Purzycki, and R. Sosis 2016. Evolutionary theory and the study of religion. In *The Oxford Handbook of the Study of Religion*, eds. M. Stausberg and S. Engler, pp. 124–136. Oxford: Oxford University Press.
- Smith, W.C. 1998. *Believing: An historical perspective*. Oxford: Oneworld.
- Smith, W.J. 1979. Ritual and the Ethology of Communicating. *The Spectrum of Ritual*, New York: Columbia University Press, pp., 51–79.

- Sosis, R. 2003. Why aren't we all Hutterites? Costly signaling theory and religion. *Human Nature* 14:91–127.
- Sosis, R. 2005. *Ifaluk Atoll: An Ethnographic Account*, in eHRAF World Cultures, ed. Carol Ember. New Haven, CT: HRAF.
- Sosis, R. 2007. Psalms for safety: Magico-religious responses to threats of terror. *Current Anthropology*, 48, 903–911.
- Sosis, R. 2009. The adaptationist-byproduct debate on the evolution of religion: Five misunderstandings of the adaptationist program. *Journal of Cognition and Culture*. 9:315–332.
- Sosis, R. 2016. Religions as complex adaptive systems. In *Mental Religion: The Brain, Cognition, and Culture*, ed. N. Clements, pp. 219–236. Farmington Hills, MI: Macmillan.
- Sosis, R., and Alcorta, C.S. 2003. Signaling, solidarity and the sacred: The evolution of religious behavior. *Evolutionary Anthropology* 12:264–274.
- Sosis, R. and Alcorta, C.S. 2004. Is Religion Adaptive? *Behavioral and Brain Sciences* 27:749–750.
- Sosis, R. and Bressler, E. 2003. Cooperation and commune longevity: A test of the costly signaling theory of religion. *Cross-Cultural Research* 37:211–239.
- Sosis, R. and Handwerker, P. 2011. Psalms and coping with uncertainty: Israeli women's responses to the 2006 Lebanon War. *American Anthropologist*, 113, 40–55.
- Sosis, R. and Kiper, J. 2014a. Religion is more than belief: What evolutionary theories of religion tell us about religious commitment. *Challenges to religion and morality: Disagreements and evolution*, eds., M. Bergman & P. Kain, pp. 256–276. New York: Oxford University Press.
- Sosis, R. and Kiper, J. 2014b. Why religion is better conceived as a complex system than a norm-enforcing institution. *Behavioral and Brain Sciences* 37: 275–276.
- Sosis, R. and Kiper, J. 2017. Sacred versus Secular Values: Cognitive and Evolutionary Sciences of Religion and Religious Freedom. In *Homo Religiosus? Exploring the Roots of Religion and Religious Freedom in Human Experience*, eds. T.S. Shah and J. Friedman, pp. 89–119. Cambridge: Cambridge University Press.
- Sosis, R., Phillips, E., and Alcorta, C.S. 2012. Sacrifice and Sacred Values: Evolutionary Perspectives On Religious Terrorism, in T. Shackelford and V. Weekes-Shackelford (eds), *The Oxford Handbook of Evolutionary Perspectives on Violence, Homicide, and War*, pp. 233–53. NY: Oxford University Press.
- Sosis, R. and J. Shaver 2015. How rituals elicit shared sacred values. *Interdisziplinäre Anthropologie* 3:75–81.
- Spiro, M.E. 1952. Ghosts, Ifaluk, and teleological functionalism. *American Anthropologist*, 54:497–503.
- Stark, R. and R. Finke 2000. *Acts of Faith: Explaining the Human Side of Religion*. Berkeley: University of California Press.
- Tetlock, P.E. 2003. Thinking the unthinkable: Sacred values and taboo cognitions. *Trends in Cognitive Sciences*, 7, 320–324.
- Tillich, P. 1957. *Dynamics of Faith*. New York: Harper and Row.
- Trimingham, J.S. 1971. *The Sufi Orders in Islam*. London: Oxford University Press.
- Turner, V. 1969. *The Ritual Process: Structure and Anti-Structure*. New York: Routledge.
- Tuzin, D. 1997. *The cassowary's revenge: the life and death of masculinity in a New Guinea society*. Chicago: University of Chicago Press.
- Von Bertalanffy, L. 1972. The History and Status of General Systems Theory. *The Academy of Management Journal*, 15: 407–426
- Wallace, A.F.C. 1966. *Religion: An Anthropological View*. New York: Random House.
- Watts, J., Sheehan, O., Atkinson, Q.D., Bulbulia, J., & Gray, R.D. 2017. Ritual human sacrifice promoted and sustained the evolution of stratified societies. *Nature*, 532(7598), 228–231.
- Weber, M. 1947. *The Theory of Social and Economic Organization*. Oxford: Oxford University Press.

- Whitehouse, H. 1995. *Inside the cult: Religious innovation and transmission in Papua New Guinea*. Oxford University Press.
- Whitehouse, H. 2004. *Modes of Religiosity: A Cognitive Theory of Religious Transmission*. New York: Alta Mira Press.
- Wilson, D.S., Hartberg, Y., MacDonald, I., Lanman, J.A., & Whitehouse, H. 2017. The nature of religious diversity: a cultural ecosystem approach. *Religion, Brain & Behavior*, 7(2), 134–153.
- Worsley, P. 1957. *The trumpet shall sound*. London: MacGibbon & Kee.