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18

Rethinking Proximate Causation and Development in Religious Evolution

Harvey Whitehouse

Abstract

Efforts to understand cultural evolution, and its articulation with biological evolution, have tended to focus on problems of ultimate rather than proximate causation; that is on issues of function and selection rather than issues of mechanism and development. Although we now have sophisticated models of multilevel selection (Wilson 2002) and gene–culture coevolution (Boyd and Richerson 1985), we lack a similarly sophisticated account of the various levels at which proximate explanation needs to be understood. This chapter attempts to sketch out a more sophisticated framework for proximate explanation in religious evolution, inspired by C. H. Waddington's notion of the "epigenetic landscape." Building on this idea, three kinds of landscapes are disambiguated: epigenetic, cognitive-developmental, and social-historical. The discussion here focuses on religious phenotypes, but the general approach would be applicable to cultural practices more generally. The aim is to bring greater conceptual clarity and integration to a somewhat complex and messy cluster of research areas and, at the same time, open up new hypotheses ripe for investigation.

Introduction

The developmental pathways of biological organisms, minds, and social systems are intimately interconnected. This is not always obvious when conducting research at these different *explanatory* levels in light of discipline-specific questions, theories, and methods. Thus, most theories in the cognitive science of religion ignore efforts to establish the genetic and neurological foundations of religiosity. Social scientists are meanwhile notoriously skeptical of psychological and biological reductionism and seldom consider the shaping and constraining effects of cognitive and physiological processes. The resulting silo effect would not be a problem if processes unfolded at these different levels independently. But they do not. Efforts to show how they are related tend to approach the subject in a rather arbitrary and piecemeal fashion. What is needed is a more integrated conceptual scheme, one that generates systematic hypotheses and provides a more comprehensive and flexible understanding of proximate causation and development in religious evolution.

Waddingtonian Landscapes

A fruitful heuristic for thinking about proximate causation and development is provided by C. H. Waddington's famous notion of the "epigenetic landscape" (Waddington 1957). The basic idea is that the development of any phenotypic characteristic (whether morphological, physiological, or behavioral) is an outcome of both genetic and environmental factors in varying degrees. To represent this complex interaction, Waddington invited us to imagine a virtual landscape (Figure 18.1) in which the contours vary and to imagine developing traits (e.g., organs) as marbles rolling down through that landscape, their descent corresponding to a process of maturation over time. In this rather elegant metaphor, genes are represented as pegs and the effects of genes are represented as guy ropes. These guy ropes tug under the surface of the landscape so as to create furrows, canalizing development toward a steady end state (the mature phenotype). The idea is that where the tug of genes is weaker, the furrows in the landscape are shallower and therefore environmental influences can push the developing phenotype onto a new path, something that could not be accomplished by the effects of genes alone.

Waddington was admittedly proposing a mixed metaphor, combining the image of a tent (the canvas of which is held taught by pegs and guy ropes) and the image of a landscape (the contours of which are formed by quite different forces, such as erosion). Although mixed metaphors are considered a faux pas

Waddington	Epigenetic landscape
Pegs	Genes
Guy ropes	Biochemical or regulatory effects of genes
Landscape	Sum of the effects of genes and environment in producing a stable end state
Steepness	Genetic robustness Steep = genetic canalization Shallow = plasticity
End state (attractor)	Mature phenotype (morphology, physiology or behavior)

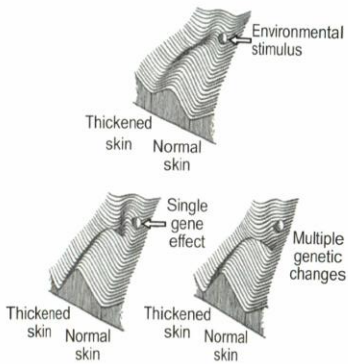

Figure 18.1 Waddington's epigenetic landscape.

in some literary circles, Waddington's works quite well because the surface of a hillside does in many ways resemble the wall of a tent. We could, however, dispense with the idea of a landscape altogether and simply think of the image of a badly pitched tent with furrowed walls and imagine developing phenotypic traits as raindrops sliding down the canvas. An added advantage of this modification is that it affords a source analog for the environment, in the form of a gusting wind that can tauten and relax the furrows of the fabric within the constraints imposed by genetic pegs and ropes. A similar modification is proposed below.

Others have also suggested thought-provoking revisions. Tavory et al. (2013) have recently extended Waddington's metaphor as a way of understanding the development of sociocultural systems. In their new version of the metaphor, pegs represent cultural traits of various kinds, and these can canalize the development of communities in much the same way as genes can canalize the development of an organ in the body. As in Waddington's original metaphor, the flatter parts of the landscape represent regions where the canalizing effects of pegs are less strongly exerted, allowing outside factors to push development in new directions. In the so-called "social-developmental landscape" these outside factors include the conscious strategies of agents in their efforts to accomplish various outcomes (Figure 18.2).

The general proposal advanced by Tavory et al. is original and thought provoking. Nevertheless it raises a host of unanswered questions. For example, what exactly do the pegs and guy ropes, etc., refer to in this social-developmental landscape? Do the pegs represent individual behaviors or recurrent *patterns* of behavior at a population level? Or do they represent *cultural maps* rather than behaviors? Is the mature phenotype a cultural system or a social group (or both or something else)?

Waddington's original analogy was not without its limitations. As noted above, the effects of the environment are not represented pictorially despite playing an important role in the story. In addition, simple one-to-one mappings of genes (pegs) and their expressions (guy ropes) do not capture well the kinds of processes described by animal geneticists nowadays. Such problems could be remedied, however, by extending Waddington's analogy such that *environmental* pegs and guy ropes *above* the landscape pull on its fabric so as to counter or exacerbate the effects of *genetic* pegs and guy ropes tugging from *below*. (These environmental dynamics need not be as Tavory et al. portray them, as we shall see.) To capture more of the complexity of the gene–phenotype relationship, instead of simple direct connections between pegs and their points of attachment to the landscape, one might imagine entangled guy ropes (somewhat more along the lines of Tavory et al.'s inverted landscape but without the inversion). Moreover, although Waddington envisaged the mature phenotype as a stable resting place in the epigenetic landscape, when applying this analogy to human development it would be more accurate to imagine the mature phenotype as a very gently descending valley floor where development

Jablonka	Social-developmental landscape
Pegs	Each peg is a distinctive cultural trait such as a norm, or skill, or story, or style of clothing, etc.
Guy ropes	Exert "pull" on the landscape via their entanglements
Landscape	Sum of the effects of cultural traits and agentive strategies in producing a stable end state.
Steepness	Steep = faithful inheritance of tradition? Shallow = innovation?
End state (attractor)	A more or less stable community or tradition?

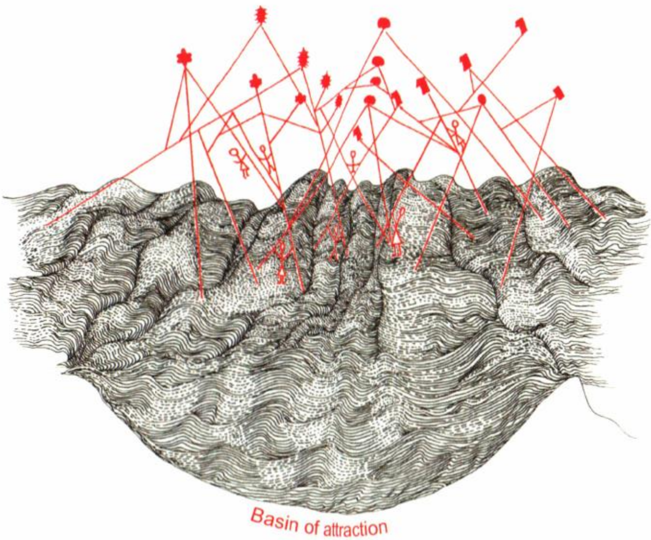

Figure 18.2 The social-developmental landscape (Tavory et al. 2013). Figure created by Anna Zeligowski and used with permission.

proceeds slowly but does not come to a halt (until death), in contrast with the much faster pace of development during immaturity.

Epigenetic Landscapes and Religious Bodies

Religion is intimately linked to physiological development in a wide range of ways through its influence, for instance, on diet, sexual behavior, drug use, and so on. Here we focus on some aspects of religiosity and brain physiology. The neurophysiology of religious thinking is little understood, but it is clearly the case that religious beliefs depend as much upon activity in the brain as would any other mental representations (Newberg and Waldman 2009). There has been some research linking religious experiences to temporal lobe epilepsy (Persinger 1983). Similar research by Urgesi et al. (2010), using brain-scanning techniques, suggests that feelings of transcendence induced by meditation are linked to decreased activity in the parietal lobe (a part of the brain involved in orienting the body to three-dimensional spaces). Other studies have sought to understand the *biochemistry* of certain aspects of religious experience, focusing on the role of neurotransmitters like dopamine in altered states of consciousness (Previc 2009). Whatever the long-term outcomes of these lines of research, they point to the presence of processes in the brain that are shaped by genes as well as culture and culturally constructed environments and practices. Religious traits are phenotypic characteristics, just like any other, and their development can be conceptualized in Waddingtonian terms in the same way as the development of organs.

To illustrate, let us consider one possible account, formulated by Boyer and Lienard (2006), of the neurological processes involved in the performance of religious rituals. Whether or not this account turns out to be correct in all (or indeed any) of its details, it can serve as an example of the epigenetic landscape of a religious phenotype. According to Boyer and Lienard, religious rituals (and cultural rituals of all kinds) activate a cluster of brain systems designed to respond to hazardous substances by triggering precautionary routines such as cleaning, separating, and straightening. They argue that these brain systems malfunction in patients suffering from obsessive-compulsive disorder (OCD), but where no such pathology is present, they serve a useful function biologically by causing people to handle potentially contaminating substances with special care. This biological mechanism, they suggest, is routinely hijacked by cultural systems that mimic the relevant input, in the form of religious rituals, for example, which similarly involve a concern with taboo or sacred materials and substances and stereotyped behavioral routines resembling those of OCD patients. Efforts to understand the neurological malfunction responsible for OCD have produced quite a detailed picture of the neural pathways involved. The most important network for understanding the hazard precaution system as described by Boyer and Lienard is a cortical-striato-pallidal-thalamic circuit (CSPT) that is connected to many other regions of the cortex via direct and indirect pathways. The basic idea is that this CSPT and its projections into the cortex, striatum, substantia nigra, and thalamus form the basic machinery for activating hazard precaution routines in normal individuals but that part of the system malfunctions in OCD patients, resulting in a felt need to repeat the routines over and over again.

Boyer and Lienard argue that the hazard precaution system has a distinctive developmental trajectory. They cite evidence that diagnostic features of the hazard precaution system, such as concern with "just right" object placement, cleaning, stereotypy, and repetition of routines, appear around two years of age and peak prior to puberty. This would seem to be consistent with the hypothesis that the evolved function of the hazard precaution system is to protect against infectious or contaminating materials during vulnerable phases of development, when exploratory play and learning is most intense and therefore the risk of exposure to hazards is most acute. Boyer and Lienard also present some evidence that OCD-like thinking peaks in women during pregnancy and in men after the birth of their first child.

To conceptualize the development of the hazard precaution system in terms of the epigenetic landscape metaphor, we might envisage a topography of relatively steep valleys during adolescence, indicating somewhat stronger genetic canalization during this phase of development (Figure 18.3). Here the "tug"' of genes and their guy ropes underneath the landscape would be stronger than during most other life stages. (These effects would result from networks of genes rather than simple one-to-one mappings between genes and development.) There would then be further valleys during reproductive phases before the landscape flattens out and a stable or "mature"' phenotype is achieved. I would propose that we extend Waddington's metaphor to represent the effects of the environment on this developmental process. Exposure to cues activating the hazard precaution system might be more or less frequent or intense for different individuals depending, for instance, on how ritualistic the environment is, how much concern there is with issues of hygiene and boundary marking, and how great the risk is of contamination and infection. A highly ritualistic religious system, such as Judaism, might serve to deepen the furrows in the landscape created by genetic canalization of the hazard precaution system and its neurological circuits. By contrast, a more iconoclastic religious system, such as a Protestant church eschewing ritual, might soften the contours of the landscape resulting in a different mature phenotype.

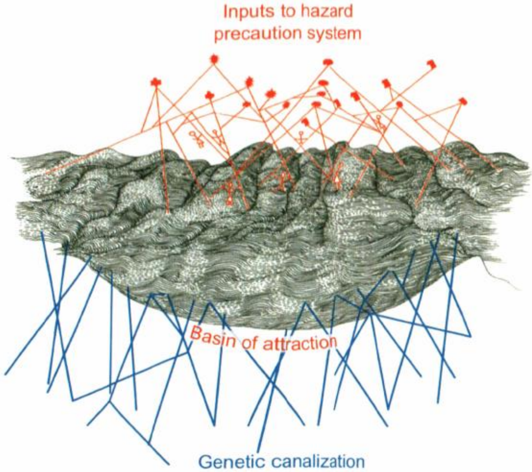

Figure 18.3 Picturing the modified epigenetic landscape.

Cognitive-Developmental Landscapes and Religious Thinking

Although cognitive processes are shaped and constrained by processes in the brain (and the genetic, cultural, and environmental influences shaping their expression and development), psychological systems are not wholly reducible to neurological ones. To understand the complexity of mentation, it is necessary to formulate theories of reasoning, memory, motivation, and emotional response at a level distinct from biological events. In short, we need to postulate a cognitive-developmental landscape as well as an epigenetic one. This cognitive-developmental landscape is closely analogous to Waddington's original scheme (Table 18.1). In this new scheme, however, pegs would represent species-specific, genetically canalized pathways in cognitive development and guy ropes would represent evolved cognitive constraints on learning. These constraints could be very strong (e.g., the impression that celestial objects move across the sky) but with a certain amount of learning and practice they can also be overcome to some extent (so we can appreciate that the earth is actually rotating).

The interaction of cognitive canalization and cultural learning in development results in more or less stable *semantic networks* in the minds of mature agents (Figure 18.4). Semantic networks are systems of representations, each representation being conceptualized as a node that is in turn linked to other nodes with varying frequency, credibility, and emotional salience. Not all nodes in a semantic network are equally easy to represent, believe, or remember. Some nodes or clusters of nodes are more intuitive than others, chiming more readily with maturationally natural and universal implicit beliefs

Table 18.1 Summary of the cognitive-developmental landscape.

	Epigenetic Landscape	**Cognitive-Developmental Landscape**
Pegs	Genes	Evolved cognitive capacities (does not require massive modularity)
Guy ropes	Biochemical or regulatory effects of genes	Cognitive constraints on learning
Landscape	Sum of the effects of genes and their effects plus environment on changing gravitational pull toward a stable end state (environment as geology?)	Sum of the effects of cognitive constraints plus cultural scaffolding on changing gravitational pull toward a more or less stable end state
Steepness	Steep = canalization Shallow = plasticity	Steep = cognitive canalization Shallow = cognitive plasticity
End state (attractor)	Mature phenotype (morphology, physiology, or behavior)	Mature phenotype (stable semantic networks)

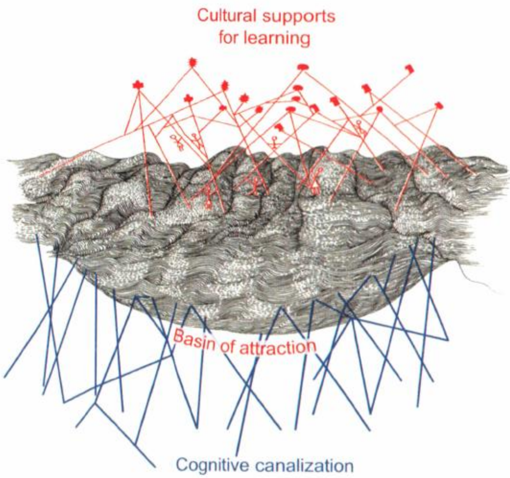

Figure 18.4 Picturing the cognitive-developmental landscape.

(McCauley 2011). By contrast, some nodes may be more counterintuitive or form part of more elaborated clusters, thus making them more difficult to acquire and maintain.

The theologically elaborated teachings of literate religions are often more counterintuitive than the "theologically incorrect" but nevertheless more widespread beliefs of rank and file laity. Consider some examples from the Roman Catholic cultural system. Many Catholics in Southern Europe cross themselves upon entering a church because they have an implicit belief that God is present in holy places even though he cannot be seen or heard. This belief forms part of a network of explicit representations supported by quite simple intuitive assumptions. Mind–body dualism, for instance, has a number of intuitive properties that would appear to recur in all human populations (Cohen et al. 2011). These include the expectation that the memories, beliefs, and desires of agents can occur outside bodies, can survive death, and can even move between bodies in the case of spirit possession or divine inspiration. Although disembodied agency is easy to represent and would therefore seem to be culturally universal, agency is intuitively tied to a location in space (Barrett and Keil 1996). Catholics do not appeal to relics several miles away but move within earshot of the relic in order to commune with it. By contrast, the Vatican teaches that God is omnipresent, a proposition that is much less intuitive and therefore difficult to implement as a guiding principle in worshipful practice. If the principle of omnipresence were really used as a guide to behavior, self-crossing would be no more necessary in churches than in other places, and it would be just as effective to address a holy relic from afar.

Similar disjunctions between intuitive lay beliefs and more counterintuitive theological systems have been observed with respect to many features of intuitive reasoning. Our predisposition to adopt teleological explanations for the functions of material objects makes it easier to represent features of the natural world as the purposeful creations of gods, ancestors, or other agents than as the products of erosion or descent with modification (Kelemen 2004). Likewise, our intuitions about immanent justice make it easier to imagine that wicked people will get their comeuppance than to absorb the intricate and often counterintuitive propositions of moral philosophy (Binmore 2005). To express this in Waddingtonian terms, some semantic networks are more strongly *canalized* than others in the course of development. In general, this means that intuitive nodes in semantic networks decay less rapidly than counterintuitive nodes.

Nevertheless, semantic networks can also exhibit remarkable plasticity. Rehearsal and review of a network of representations, even of a complex and counterintuitive network, can strengthen the links between nodes. Theologians overcome the limitations of intuitive reasoning producing religious phenotypes quite different from what would be expected based on processes of cognitive canalization alone (Slone 2004). There is some evidence that emotional arousal as well as rehearsal and repetition can aid the formation of elaborated counterintuitive religious systems. Costly signaling (Sosis and Alcorta 2003) and "credibility enhancing displays" (Henrich 2009a), such as self-flagellation or large charitable donations, can meanwhile increase the plausibility of semantic networks (see also Slingerland et al., this volume). Logic and narrative used in the teaching of religious doctrines can help to make a body of orthodox teachings more memorable as well as more coherent and believable (Whitehouse 2000). External mnemonics, such as sacred texts, can also help to preserve semantic networks over time.

Another approach that has proven useful in the study of religion's cognitive-developmental landscape is to construct agent-based models. This allows us to vary the effects of cognitive canalization, emotional salience, repetition, conformism bias, and prestige bias. Although computational simulations cannot tell us directly about the workings of the real world, they help us understand our own theories better, enabling us to generate more precise and testable hypotheses (Whitehouse et al. 2012).

Social-Historical Landscapes and Religious Traditions

Semantic networks can be communicated as public representations, for instance, by means of speech, text, or body decoration. Individuals sample public representations around them and update their semantic networks accordingly, with the result that meaning systems can be largely shared across entire populations. The sum of all people's semantic networks in a bounded population can be described as a "sociocultural system." As in Waddington's epigenetic landscape, the pegs in a sociocultural-historical landscape would represent information (Table 18.2), but rather than pegs encoding information in genes (or in minds in the case of the cognitive-developmental landscape) pegs would now represent a set of normative beliefs and behaviors in a population; in other words, its "social structure." Guy ropes would now represent the implementation of these rules in practice: sometimes people follow the rule book to the letter but at other times they innovate, as their individual strategies unfold on the ground (this is sometimes described as "social organization" as distinct from the normative rule book of social structure). The sum of the combined effects of social structure and social organization, on the one hand, and various environmental forces acting on a population (such as invasions and natural disasters), on the other, determine its historical trajectory. Inasmuch as some sociocultural systems eventually coalesce into relatively stable forms, they may be said to achieve their mature phenotype (change becoming very gradual like the aging process in the body). Like organisms, however, sociocultural systems have a finite life span (they "rise and fall" or evolve into something else). Some never accomplish stability or die young.

The formation of some religions is heavily canalized by social structure, for instance in the case of some of the stricter Protestant denominations of Christianity that maintain a rigid orthodoxy through the use of unrelenting repetition of the creed, its codification in text, and the supervisory prominence of doctrinal authorities. Other traditions, such as New Age cults and fashions,

Table 18.2 Summary of the social-historical landscape.

	Epigenetic Landscape	Social-Historical Landscape
Pegs	Genes	Shared semantic networks (aka "social structure": institutional instruction manual)
Guy ropes	Biochemical or regulatory effects of genes	Cumulative social-behavioral effects of the rules and models encoded in semantic networks (aka "social organization": agency in action)
Landscape	Sum of the effects of genes and their effects plus environment on changing gravitational pull toward a stable end state (environment as geology?)	Sum of the effects of social structure and organization plus environment (e.g., invasion, revolution, tsunami) on changing gravitational pull toward a more or less stable end state
Steepness	Steep = canalization Shallow = plasticity	Steep = social structural canalization Shallow = social structural plasticity
End state (attractor)	Mature phenotype (morphology, physiology, or behavior)	Mature phenotype (more or less stable cultural system, i.e., distributed and standardized semantic networks at the population level)

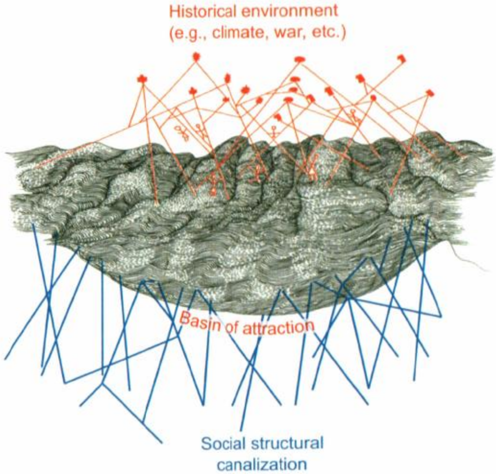

Figure 18.5 Picturing the social-historical landscape.

exhibit much greater plasticity, and the canalizing effects of social structure are weaker. Where the pull of social structure is weaker, the development of the tradition will be more easily influenced by changes in the historical environment. These environmental factors will exercise a correspondingly weaker impact in the more normatively canalized traditions (Figure 18.5).

Multilevel Landscapes in Religious Evolution

Epigenetic, cognitive-developmental, and social-historical landscapes shape and constrain each other. For example, genetically canalized neural systems constrain our psychological susceptibility to particular nodes in semantic networks. Practice and review of these networks can, however, extend our capacities for reasoning and memory (outcomes in the cognitive-developmental landscape), and thus the uniformity and stability of cultural representations across human populations (outcomes in the social-historical landscape). In other words, processes unfolding in any given landscape can have major consequences for processes in all the others.

The Evolution of Melanesian Cargo Cults

To illustrate, consider the many so-called "cargo cults"' of Melanesia that blossomed in the wake of colonization and missionization by Western powers, mainly during the twentieth century. The term "cargo cult" is typically used to

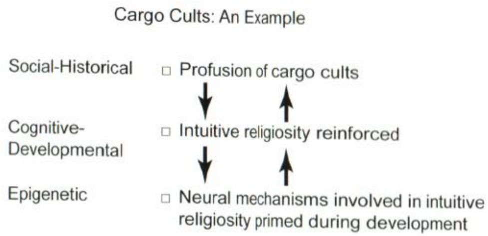

Figure 18.6 Some causal relations between epigenetic, cognitive-developmental, and social-historical landscapes in cargo cults.

refer to groups which believe that the wealth, technology, and high standard of living in postindustrial societies have a supernatural origin and can be obtained by appealing to spirits, ancestors, or gods. A variety of epigenetic, cognitive-developmental, and social-historical processes came into play in the evolution of the cargo cult phenomenon. Moral intuitions, for example, played an important role in the cognitive-developmental landscape. Cult leaders foretold that the great imbalances of wealth between native peoples and the colonists would be leveled or reversed and enemy tribes would be vanquished or punished. Prophets also appealed to intuitions about mind–body dualism (e.g., predicting that the spirits of the dead would be reincarnated), about the efficacy of ritual (e.g., by means of which the cargo would materialize), and about acts of creation (e.g., on the part of primordial ancestors). Little is currently known about the role of genetic processes in the development of the neural systems involved in intuitive reasoning about hazard precaution, immanent justice, mind–body dualism, and promiscuous teleology. Nevertheless, social-historical systems postulating supernatural agent concepts presumably fine-tune the maturation of intuitive reasoning in various ways, and this would naturally also impact the development of neural pathways. Thus, these three levels of analysis are interconnected (see Figure 18.6).

Interacting Landscapes in the Kivung

To explore how these interactions might unfold in practice, let us consider a concrete example: the Kivung movement of New Britain, Papua New Guinea (Whitehouse 1995). Like most cargo cults in Papua New Guinea, the Kivung was based on a set of highly intuitive propositions about human origins, the return of the ancestors, the arrival of cargo, and the righting of wrongs. However, whereas all other cargo cults in New Britain had flared up and then disappeared just as rapidly, the Kivung had unusual staying power and it spread to a much larger population than any of the earlier cults. Moreover, it offered a doctrinal system and orthopraxy more elaborate than any previous cult. Some of the movement's teachings went far beyond merely intuitive ideas, postulating a complex theology comparable to missionary Christianity, with all its attendant dogmas and a corpus of parables and stories linking them together. Kivung beliefs and practices formed an extensive religious system that became standardized in the 1960s and has remained much the same ever since. How are we to explain the success of this cultural system?

The Kivung was more persuasive, enduring, and widespread than other creeds in part because it exploited the cognitive-developmental landscape in a novel way: *It subjected its theories and stories to frequent repetition at public gatherings.* This seemingly minor alteration in the cognitive-developmental landscape allowed a single coherent body of teachings and practices to become standardized across the movement as a whole, changing the social-historical landscape (Whitehouse 1995, 2000, 2004). It meant that much more elaborate semantic networks than those featured in earlier cargo cults could now be sustained in memory. This would, of course, have had consequences for the development of neural processes involved in semantic memory, rote learning, narrative construction, oratorical expertise, and so on, but it would also facilitate the regional homogenization of the tradition and its orthodoxy at a population level (see Figure 18.7).

In the example just given, the ramifications of a change in one landscape had feedback effects in the others. That is, a change in cognitive development (doctrinal learning through rehearsal and review) occasioned changes at both epigenetic and social-historical levels, which fed back into cognitive development by strengthening certain forms of expertise and memory from below and stabilizing normative rules from above. Still, one can easily imagine other patterns, for instance where changes in the three landscapes occur in a cyclical fashion. Consider the following example.

When the Kivung was first established, its leaders declared that followers should no longer chew betel nut (a widespread and somewhat addictive practice in Papua New Guinea). The explicit rationale for tabooing betel nut was that the red substance produced (and spat around on the ground) was akin to menstrual blood, considered by some of the ethnic groups joining the Kivung to be polluting and dangerous. Linking betel nut to menstrual blood made the practice of chewing suddenly seem disgusting—a transformation in

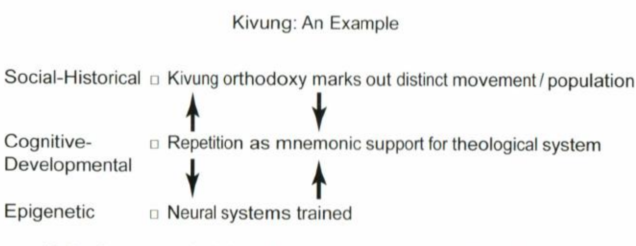

Figure 18.7 Some causal relations between epigenetic, cognitive-developmental, and social-historical landscapes in the Kivung.

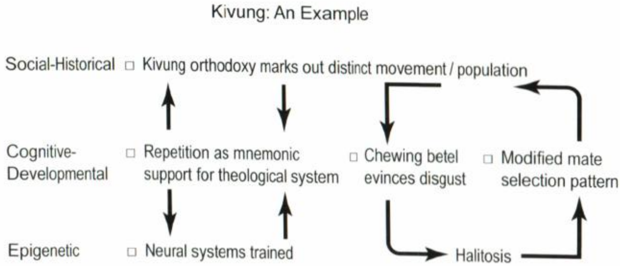

Figure 18.8 Further causal relations between epigenetic, cognitive-developmental, and social-historical landscapes in the Kivung.

the cognitive-developmental landscape of Kivung followers. An unintended consequence of this lifestyle change was the emergence of widespread dental problems, especially halitosis, which had previously been prevented by betel chewing. This change in the epigenetic landscape affected the perceived attractiveness of Kivung followers, at least to outsiders, and affected processes of mate selection in the cognitive-developmental landscape (see Figure 18.8). Resulting changes in patterns of marriage made the Kivung movement increasingly endogamous. This, in turn, sharpened the boundaries between in-group and out-group in the social-historical landscape. Sanctions were introduced to deter betel chewing among followers, reinforcing the normative social system but also impacting the psychological association of betel nut with sinfulness and pollution. In this way, a cyclical pattern of reinforcement for this novel aspect of life in the Kivung became established.

Of course there are many other patterns of this kind that could be hypothesized using the landscapes metaphor. The examples given here are merely to show how this can open up a new perspective on processes of religious evolution, and sociocultural evolution more generally.

Conclusions

The landscapes metaphor brings conceptual integration to a very complex set of multilevel relationships between proximate causation and development in religious evolution (and sociocultural evolution more generally). Magical thinking, mind–body dualism, creationism, and a host of other patterns of reasoning commonly associated with religion derive, at least partly, from evolved neural processes that are also influenced in development by social and cultural environments. This is hardly controversial and yet expressing it this way is vague and potentially confusing. What are the processes and what is their provenance? Efforts to answer that question have made progress but often only within narrow parameters, thus losing sight of the bigger picture. As a consequence, many researchers in the cognitive science of religion have argued that explaining religion is largely a matter of identifying universal cognitive predispositions and susceptibilities to believe certain things rather than others (e.g., Boyer 2001; Barrett 2004). Although this has produced much valuable research, it tends to overlook the fact that all religious representations are part of cultural systems with highly variable content and structure. These systems sometimes foreground intuitive ideas but can also exclude or obscure them with widely varying consequences for history, individual experience, and physiological processes—all of which often have important feedback effects. Scientific research on religion, therefore, suffers from a "silo effect" whereby neuroscientists look for religion "in the brain," cognitive scientists emphasize intuitive biases, and social scientists privilege systemic patterns at the level of populations. Hardly anyone seriously considers how these different aspects of religious evolution are interconnected.

As well as bringing greater clarity and integration, the landscapes metaphor opens up new hypotheses. If we look more closely at religion through the lens of the epigenetic landscape metaphor we begin to ask not only about processes in the brain but in the organism as a whole. The role of betel nut in dental hygiene is a fairly random example but consider how many religions taboo recreational drugs, most commonly alcohol. How has this affected or been affected by cognitive development for individuals growing up in culturally heterogeneous cities, where alcohol is freely available and widely used, and how has this impacted or been influenced by processes of sociocultural reproduction and change? Questions which traverse the boundaries of biology, individual psychology, and social systems are seldom asked or only posed in a way that narrowly focuses on the seemingly idiosyncratic interests of particular researchers, rather than being systematically derived from a single overarching conceptual framework. Although this chapter only sketches the contours of how such a framework might be developed, the aim is to generate discussion that would refine and improve the approach, so that it can be rendered more precisely and its implications for empirical research fleshed out more comprehensively.

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