



Whence Collective Rituals? A Cultural Selection Model of Ritualized Behavior

ABSTRACT *Ritualized behavior* is a specific way of organizing the flow of action, characterized by stereotypy, rigidity in performance, a feeling of compulsion, and specific themes, in particular the potential danger from contamination, predation, and social hazard. We proposed elsewhere a neurocognitive model of ritualized behavior in human development and pathology, as based on the activation of a specific *hazard-precaution system* specialized in the detection of and response to potential threats. We show how certain features of collective rituals—by conveying information about potential danger and presenting appropriate reaction as a sequence of rigidly described precautionary measures—probably activate this neurocognitive system. This makes some collective ritual sequences highly attention-demanding and intuitively compelling and contributes to their transmission from place to place or generation to generation. The recurrence of ritualized behavior as a central feature of collective ceremonies may be explained as a consequence of this bias in selective transmission. [Keywords: ritual, cognition, evolution, epidemiology, cultural transmission]

WHY DO PEOPLE, the world over, seem compelled to engage in ritual practices? Why invest time and resources in such behaviors? We suggest here that we may have the rudiments of an answer. Rituals are compelling because specific aspects of human cognitive architecture make these behavioral sequences attention-grabbing, intuitively appropriate, and compelling. Specifically, we consider that particular sequences of collective rituals activate a cognitive-emotional system focused on the detection of and reaction to potential danger. This *hazard-precaution system* responds to a specific set of cues in people's environments and makes certain types of precautionary action seem intuitively appropriate. The system is manifest not just in reactions to potential danger but also in individual ritualization, either normal or pathological (Boyer and Liénard in press).

We propose that instructions and actions typically found in collective rituals share core features with the information that normally activate the hazard-precaution system. This makes the ritual procedures attention-grabbing and compelling, which in turns explains their good cultural transmission.

NO "THEORY OF RITUAL": A MODEL OF RITUALIZED BEHAVIOR

According to the late Roy Rappaport, a proper account of ritual should address the question why do human beings engage in rituals at all?, which remains unanswered in anthropological or psychological theories (Rappaport 1999). There are specific reasons for this failure but also a general problem with the very notion of a "theory of ritual."

The problem lies with the concept of ritual itself. There is no clear criterion by which cultural anthropologists or other scholars of religion or classics determine that a particular type of behavior is or is not an instance of a ritual. True, there seem to be many "definitions" of ritual in anthropology (see, e.g., Gluckman 1975, among many others). But these so-called definitions are, in general, summaries of causal theories ("ritual expresses symbolism," "ritual is the manifestation of social status," etc.) rather than behaviorally precise criteria. "Ritual," like "marriage" or "religion," is not a proper analytical category; instead it is more of what Rodney Needham described as a "polythetic" category, in which, typically, ritual types A and B may share features [m, n, p], types Y and Z may share [p, q, r], Z and

W share $[q, r, s]$ (Needham 1975). And although A and W apparently do not share any major feature, they are both called “rituals.” That is why it is certainly futile to collect many instances of what are commonly called “rituals” and to tabulate their common features. This too often results in very vague formulations that would potentially apply to any social institution.

In this project we focus on ritualized behavior, a concept that we construe, in a manner directly inspired by Rappaport, as a specific way of organizing the flow of behavior, characterized by compulsion (one must perform the particular sequence), rigidity (it must be performed the right way), redundancy (the same actions are often repeated inside the ritual) and goal demotion (the actions are divorced from their usual goals; see Bloch 1974; Humphrey and Laidlaw 1993; Rappaport 1999). Note that although ritualized behavior in this precise sense is typically the hallmark of ceremonies we call “rituals,” it certainly is not found in all of those. Conversely, there may be many contexts outside “rituals” that include ritualized behavior.

Why should we abandon “rituals” and focus on ritualized behavior? Because the latter is characterized in terms that make the identification of particular instances empirically tractable. There may be ambiguous cases at some point, but this is nothing to worry about, as long as our characterization lends itself to empirical investigation.

So we are effectively asking the question what are the effects of ritualized behavior, such that individuals find collective rituals attention-grabbing and participation in such ceremonies compelling? Obviously, there are many specific reasons (including coercion, commitment, habit, or belief) justifying why a particular person should find a particular ceremony of interest and participate in it. These factors will vary enough between cultures, periods, and individuals that they cannot explain the general recurrence of ritualized behavior. Some general features or effects of this kind of scripted, rigid, and so forth behavior should explain why, all else being equal, it appears with such frequency in human cultures.

We address this question in the framework of a cultural selection framework. The main points of such a framework have been explained by others (Boyd and Richerson 1985; Durham 1991; Sperber 1985), so we only mention two important points that impinge on our argument. First, recurrent features of human cultures are the winners in a constant process of generation and selection of new variants. What we observe as cultural representations and practices are the variants found in roughly similar forms in a particular place (Boyd and Richerson 1985). Those particular sets of representations have resisted better than other changes and distortions through innumerable processes of acquisition, storage, inference, and communication (Boyer 1998; Sperber 1985). This may be because they constitute cognitive “attractors”—that is, optimal activation of particular mental resources (Sperber 1996). Second, cultural transmission does not consist in the downloading of information from cultural elders, but in

the inferential construction of conceptual structures from available (and generally fragmentary) information (Sperber 1996). So the acquisition, storage, and communication of those representations we call “cultural” are crucially affected by general features of human minds that should and can be independently established. Inferential processes are generally not accessible to conscious inspection, which is why experimental methods are required. Applied to the problem at hand, this suggests the following:

- There are collective rituals in human groups because certain sets of actions are selected through cultural transmission as more compelling or “natural” than other possible sets of actions. We need not assume a specific human need or capacity to perform collective rituals. All we have to assume is that, in given circumstances, these sets of actions seem more appropriate than others—certain ritual sequences are found more attention grabbing or memorable than others.

and

- The selection can be explained in terms of specific features of human psychological architecture. Rituals are not performed simply because “that’s the rule” and because people absorb the conceptual schemata of their cultures. Ritual performances produce specific effects in participants that result in subsequent performance. So we must document those cognitive systems most likely to be activated by ritual performances and gather independent evidence on the effect of such activation.

THE “OBVIOUS” FEATURES OF RITUALIZED BEHAVIOR

An Example

Let us start with an example of the kind of behavior we consider here. This is taken from the ethnographic fieldwork of one of us (Liénard) among the Turkana of Kenya. As this vignette serves as illustration only, we deliberately omitted all the rich cultural background that is associated with this particular sequence of actions (see Liénard in press for the relevant information).

The ritual sequence partly described here is called *ariwo*. For this specific instance, it entails the sacrifice of an ox. Its coat should be of a specific color and shine. The animal should ideally be sacrificed by a left-handed twin. In the sequence preceding the sacrifice, ritual participants circumambulate the ritual scene three more times and then gather in a semicircle, facing East. The animal is made to go around the dancers three times counterclockwise. At some point in the ritual, the members of the clan offering the ox approach one at a time the sacrificial ox and carefully rub their body from forehead to loin on the animal’s forehead, in a gentle upward thrust, an operation made difficult by the animal’s attempts to get loose and to shake its head violently.

The ritual officer cuts the animal lengthwise at the level of the diaphragm and upper abdomen. The body is then spread at the center of the ritual scene. During the next phase of the ritual, clans regroup and people line up to

cross finally the ritual field from West to East walking right through the ox's split body, being careful to tread on a puddle of chyme—taken from the animal's stomach—in which has been placed the axe used to give the ultimate death blow. Among the crowd of each clan, elders and men are first to pass, followed by adolescent girls and girls of marriageable age, then come the mothers with children, and finally the young unmarried men. The sacrificer and his assistants make sure that everyone passing through the carcass steps on the axe placed in the chyme before proceeding.

Now ethnographers observing this kind of behavior would proceed to do two things. They would describe the particular reasons why people engaged in these specific acts on that occasion and they would detail the many representations that Turkana participants are likely to associate with these different actions. These two kinds of descriptions are essential to Turkana ethnography and are indeed provided elsewhere (Liénard 2006). Neither description, however, will be sufficient to address the fundamental question raised here: Why engage in ritualized behavior in this context? To do that, we must first outline the general features of ritualized behavior that this sequence illustrates.

The Obvious Features

When Rappaport enjoined anthropologists to explain ritual, he listed what he called the "obvious" (i.e., obvious to all anthropologists) aspects of ritual—those frequent features that a decent model should explain (Rappaport 1979):

- *No obvious empirical goals: "meaningless" acts.* There is no clear point in walking the ox round the dancers—or, for that matter, the dancers around the scene. More generally, in rituals one typically washes instruments that are already clean, one enters rooms to exit them straightaway, one talks to interlocutors that are manifestly absent, and so forth. Frequent repetition bolsters this intuition that actions are disconnected from their ordinary goals. People bow or kneel repeatedly; they walk round an animal seven times, which clearly signals that no effect is achieved by any specific iteration of the action. Also, many rituals include actions for which there could not possibly be any clear empirical goal, such as rubbing an animal's forehead with one's body, passing a chicken from hand to hand in a circle, or going round a temple seven times. True, a given ritual generally has a specific purpose (e.g., healing a particular person) but the set of sequences that compose the ritual are not connected to this goal in the same way as subactions connect to subgoals in ordinary behavior (Boyer 1994). In other words, the standard connections between means and ends seem broken in ritual. Practitioners themselves often concur that the actions are "meaningless," although efficacious (Humphrey and Laidlaw 1993). Obviously, in many religious traditions some scholarly specialists and theologians can produce justifications for each particular action but these rationalizations are absent in most nonliterate societies (Barth 1987) and remain inaccessible or uninteresting to most participants in all traditions (Boyer 2001). Moreover, far from providing a straightforward rationale for ritual actions, the specialists' exegesis often creates mysteries that require further symbolic exegesis (Sperber 1975).
- *Compulsion.* In the Turkana example, a diviner has established that people of a particular clan should offer, on behalf of everyone, the sacrifice of an ox as a remedy against misfortune but also as a protection against potential risks like enemy raids, intrusions, and pandemics. Even though the actual risk incurred is loosely specified employing commonplace threats, the decision to act is impervious to scrutiny. More generally, given certain circumstances, people just feel that they must perform a specific ritual, that it would be dangerous, unsafe, or improper not to do it. It is important to distinguish these feelings, this compulsive character of ritualized action, from the explanations people may have about the reasons for performing the ritual (Boyer 2001).
- *Literalism and rigidity.* Turkana people will be careful to walk the ox three times counterclockwise round the dancers, to have specific participants rub in a particular way their body on the animal's forehead, and to have everybody properly crossing the ritual field, stepping at one point on the axe in the chyme. The intricacy of the details and the prescriptions is the hallmark of ritualized behavior. People feel that they should perform the ritual in the exact way prescribed and generally in the way it was performed on previous occasions. This obviously does not mean that ceremonies are actually performed in the same way (Goody 1972, 1986). What is important is that people strive to achieve a performance that matches their representation of past performances, and that they attach great emotional weight to any deviation from that remembered pattern (Boyer 1990).
- *Repetition, reiteration, redundancy.* Repeated enactments of the same action or gesture—as well as reiterations of the same utterances—are typical of many collective rituals. A given sequence is executed three or five or ten times. What matters is the exact number. What matters too is that the action should seem identical in all these iterations. This makes many ritual sequences clearly distinct from everyday action, in which there is either no repetition of identical sequences (e.g., in assembling a musical instrument, one performs a series of unique actions), or each repeated sequence has a specific outcome (in weaving, the warp is changed at each step), or repetition is cumulative (the egg whites rise only after a long period of stirring). In ritual action, repetition itself is not motivated but strongly prescribed and perceived as intrinsically efficacious.
- *Order and boundaries.* This was visible in our Turkana vignette. There is a special space of the sacrifice, where normal behavior is suspended and particular acts must be performed. The dancers must be aligned in a particular way relative to the animal. They must walk through the body of the sacrificed animal along a specific path and

direction. In many rituals, people create an orderly environment that is quite different from the one of everyday interaction. People line up instead of walking, they dance instead of moving, they wear special clothes or makeup, they build alignments of rocks or logs, they create elaborate color and shape combinations, and so forth. There is a lot of ordering in rituals that is quite distinct from the comparatively unpredictable patterns of non-ritual environments. Related to this is the recurrent concern with delimiting a particular space (a sacred circle, a taboo territory) often made visually distinct from the other, unmarked space. People also often emphasize the boundary between this space and the rest, for instance by special prohibitions (only men enter the sacred circle, only women sit on the left side, etc.) or by restrictions on communication between marked and unmarked spaces.

- *Specific concerns.* Pollution and cleansing, protection against invisible dangers, and the creation of a special space and time are common themes associated with ritualized behavior. It is clearly the case for our Turkana ritual. The whole endeavor is understood and justified as a way of countering and chasing away a menace. The danger is understood as a threatening intrusion, an amalgam of overexposure to potential enemy onslaught, sickness, and other likely threats. Whipping the dancers is done “to chase the disease away.” Profusely splashing people at regular interval is intended “to disconnect” people from potential ills by “cooling” them. By stepping on the axe buried in the chyme, participants should “sever” themselves from the disease on the spot. In many cultural contexts, the ritual space or instruments are often described as “pure” (or on the contrary as the locus of concentrated “pollution”), or the point of the ritual is to “purify” people or objects or to “cleanse” minds or bodies. This is not just a matter of metaphors. In many rituals, blood, semen, or excrement are a primary concern, the miasma or smells of decaying corpses are important, and the use of water or fire as possible ways of getting rid of pollution and contaminants is also recurrent. There are also innumerable examples of allusions to purity and pollution in ritual requirements. People must wash before prayers, they immerse themselves in water to rid themselves of pollution, they must wear spotless garments, the sacrificial animal must be absolutely clean, menstruating women (supposedly polluted) are barred from rituals spaces, and so on. This concern with pollution and cleansing is so prevalent that it has been considered a foundation of religious ritual (Douglas 1982).

BACKGROUND TO RITUALIZATION

Rappaport rightly pointed out that most cultural anthropological accounts of ritual simply ignore the “obvious” properties listed above (Rappaport 1979). Many ethnographic accounts focus on the specific reasons for participation in

ritual in a given cultural context (e.g., a specific ritual legitimizes claims to high status or marks territorial boundaries) rather than the general features of this kind of behavior (Gluckman 1975). Also anthropological theories often emphasize processes (the transmission of norms or of shared cultural symbolism, or a demonstration of social commitment, etc.) that could and do occur also outside ritualized behavior; these, therefore, do not explain the specific features of rigidity, scriptedness, and so forth (Rappaport 1999; Staal 1990). This is particularly true of functionalist accounts. Some theories claim that rituals provide ethnic affiliation or reinforce religious belief but do not provide any account of why or how these functions require rigid sequences or repeated episodes or any other of the recurrent features of collective rituals. From a different perspective, rituals are often said to be “symbolic” (Basso and Selby 1976), which has led anthropologists to see rituals as conveying culturally coded meanings. Again, this interpretation begs the question of why such meanings would require ritualized actions—why they would require those actions to be expressed or sustained. Besides, most rituals do not actually convey coded meanings except in the vaguest sense (Sperber 1975). Typical features of rituals—such as the use of standardized formulaic speech, repetitions, and redundancy as well as the great number of obviously pointless actions—would seem to reduce the information potential of rituals (Bloch 1974; Staal 1990).

Beyond these very general points, only a few theoretical frameworks actually address the central question of the kinds of action typical of ritualized behavior. We briefly discuss them before proceeding to our cognitive framework.

Cognitive Background: Ritual and Ordinary Action

Ritual action should be studied in the context of human dispositions for organized action in general. Understanding the cognitive processes engaged in the ritualization of behavior surely requires at least some minimal understanding of the cognitive underpinnings of action representation. Although it may seem self-evident, the requirement is ignored in most accounts of ritual.

A notable exception is E. Thomas Lawson and Robert N. McCauley’s cognitive account of religious ritual (Lawson and McCauley 1990), which inaugurated the field of cognitive studies of religion. Although most of the argument is about the specific features of religious ritual, and therefore only partly relevant to our problem, it makes sense to take this framework as a starting point. A central assumption of the model is that ritual actions are only a subset of actions, and therefore a large number of principles that govern action-representation are inherited in the specific domain of ritual. These principles specify, for instance, that the structure of action-representation is *partonomic* (small units with specific goals are included in larger units with larger goals but do not straddle the boundaries of two larger units; Newton 1973; Zacks et al. 2001) and that there are

only limited possible mappings between specific ontological categories (person, object, animal) and “slots” in action-description (agent, patient, instrument; see Lawson and McCauley 1990). Religious believers’ intuitions about the format of their rituals, as well as about the format of possible rituals they never witnessed, are governed by these general rules of action-representation (Barrett and Lawson 2001). What is specific to religious ritual, then, is not a way of representing action but the insertion of supernatural agents in the agent and patient positions of otherwise ordinary rules (McCauley and Lawson 2002).

Phylogeny of Ritual

What is the connection between collective rituals practiced by human beings, on the one hand, and animal displays and routines, on the other hand? Some authors have chosen to emphasize the common features, which are particularly important as regards the sequencing and repetition of action (Gluckman 1975; Staal 1990). However, it is quite clear that human rituals include specific preoccupations (e.g., with ritual cleansing, with unseen dangers) that do not seem to be present in animal displays or other rituals (Fiske and Haslam 1997). Debating whether animal and typically human rituals are continuous or not may not be the most fruitful strategy, unless we understand what these parallels could explain and how.

The main point of continuity between collective and animal rituals may lie in the simplification of communication, in the ostension of intentions that is accomplished through rituals. Rituals in many animals reduce the cost of communication by transmitting honest signals of fitness or dispositions (Bradbury and Vehrencamp 2000; Gintis et al. 2001). For instance, ritualized fights save males the fitness cost of actual fights (Watanabe and Smuts 1999). More generally, displays and rituals make the transmission of simpler messages more efficient (Payne 1998). Collective rituals too set up a special form of communication with greatly impoverished propositional content (Bloch 1974, 1998). The relationship between expressive displays, on the one hand, and ritualized behavior, on the other hand, is not as straightforward as one might imagine. Expressive behavior finds its *raison d’être* in the communication of signals relevant for interaction. Although collective rituals do fulfill specific social functions and goals (among which the transmission of specific signals should be counted), we believe that the characteristic features and contents of human ritualized behavior cannot be accounted only in those terms.

Furthermore, phylogenetic considerations do not by themselves provide a full evolutionary account of any behavior (Tooby and Cosmides 1989)—that is, even if we consider that ritualization in several species is a single phenomenon, it remains to explain whether rituals in humans are only an atavism or constitute a specific adaptation. What would be the possible adaptive value of this propensity for rigid scripting of joint action?

Adaptationist Models: Group Cohesion and Signaling

Some evolutionary anthropologists have suggested that rituals create coordination and therefore group cohesion (Sosis 2000). Collective rituals typically require group-scale coordination between agents. However, although it is true that rituals require coordination, it is also true that many domains of everyday social interaction in humans require it too but are not accompanied by ritualized behavior. Indeed, part of our human-evolved cognitive equipment consists of cognitive capacities that allow large-scale coalitional alliances, which imply some measure of coordinated action (Harcourt and de Waal 1992; Kurzban et al. 2001). This would suggest that there is no need for humans to use rituals as a way of creating social alliances: They already have the tools for that. It is clear, however, that rituals may seem intuitively appropriate for demonstrations of commitment (Gintis et al. 2001; Sosis 2003). To perform the ceremonies, people must not only agree on a particular script of what actions must be performed when, but also they must collaborate in the performance and they display this cooperation. In this way, rituals may reinforce not just cohesion but public commitment to cohesion, which in itself constitutes a powerful incentive for other agents’ display of commitment (Kuran 1998).

This is related to the fact that many collective rituals are exceedingly expensive, either in resources or in direct fitness, as they put some participants in great danger. Male initiation, for instance, is said to turn boys into full-blown men, but its often painful ordeals typically transmit none of the skills or knowledge associated with manhood in the groups concerned (Bloch 1992; Houseman 2002). What would motivate people to engage in such rituals? One possible answer is that these rituals constitute “commitment” devices (Frank 1988; Schelling 1960). Expensive or fitness-reducing rituals may constitute an elaborate form of signaling fitness, not despite their costs but because of them (Zahavi and Zahavi 1997). Evolutionary anthropologists have noted that expensive religious rituals in particular constitute hard-to-fake signals of commitment to statements, the only guarantee for which is other people’s commitment (Bulbulia 2004; Irons 2001; Sosis 2003).

RITUALIZATION PROPER, INDIVIDUAL AND COLLECTIVE

We consider all these findings and hypotheses of great interest—indeed, they provide the foundations of the model presented below. However, it is also clear that they still leave a crucial piece of the explanation missing. There is simply no description of the capacities involved in ritualized behavior. There is no general account of how and why human minds find these sequences attention demanding and compelling. In other words, Rappaport’s question remains largely unanswered. Cognitive models focus on continuities between ordinary and ritual action, and it remains to explain the differences. Phylogenetic models

provide little explanation for the possible adaptive value of a human disposition to perform rituals. Adaptationist models are still tentative, as they do not include a precise description of the cognitive machinery underpinning ritual action. So they fail so far to provide the proximate cognitive mechanisms required for testable evolutionary psychological models (Ketelaar and Ellis 2000). This is precisely what we aim to provide here.

Diverse Domains of Ritualization

In our view, features of collective rituals can be explained only if we leave aside cultural institutions for a while and turn to ritualized behavior that can be observed in diverse circumstances and with different consequences. This is why we must review the occurrences of such behavior in contexts that are neither collective nor “ritual” in the usual anthropological sense—behaviors whose psychological underpinnings may illuminate collective ritualization.

- *Children's rituals.* Most children engage in ritualistic behaviors at a particular stage of development, starting at age two, peaking at age five, and subsiding around age seven. These behaviors are usually considered part of normal development, distinct from the severe symptoms of OCD (see below; Leonard et al. 1990). The age of onset is similar in different cultures, as are the themes of ritualistic behavior: perfectionism, attachment to favorite objects, concerns about dirt and cleanliness, preoccupation with just-right ordering of objects, preferred household routines (Zohar and Felz 2001). Specific action sequences must be performed—there is a compulsion to engage in the activity. The ritual must also be performed in a precise way, as deviations are intuitively felt to be dangerous (Evans et al. 1999).
- *Obsessive-compulsive disorder.* In some people, intrusive thoughts and compulsions can evolve into full-blown obsessive-compulsive disorder. The main feature of the pathology is a strong compulsion to engage in stereotyped and repetitive activities with no rational justification (American Psychiatric Association 1994). Some patients engage in bouts of washing or cleaning tools or utensils (Hodgson and Rachman 1972). Others verify that they locked their door, rolled up the car window, or turned off the gas knobs over and over again (Hodgson and Rachman 1977). Still others engage in constant counting activities or need to group objects in sets of particular numbers (Radomsky et al. 2001). In most cases the ritual seems to be an intuitive response to obsessive thoughts about potential danger, notably contamination and contagion (e.g., fear to catch other people's germs, to ingest contaminated substances, to pass on diseases to one's children or others), possible harm to others or to oneself (e.g., handling kitchen utensils and wounding people), as well as social ostracism following shameful or aggressive acts (thoughts about assaulting others, shouting obscenities, exhibitionism, etc.).
- *Life-stage-relevant intrusive thoughts.* Thoughts about potential danger and appropriate precautions are not confined to the clinical population. On the contrary, systematic studies of the themes of OCD have shown that most normal people experience the same kind of intrusive thoughts as patients and to some degree generate the same ritualized action-plans to avoid such dangers (Rachman and de Silva 1978). Intrusive thoughts often become more focused and more bothersome at particular phases in the lifespan, notably the final stages of pregnancy and motherhood and fatherhood. A review of these phenomena suggests that senseless, intrusive, unacceptable ideas, thoughts, urges, and images about infants are common among healthy parents of newborns. The content of these intrusions resembles that found in clinical obsessions (Abramowitz et al. 2003). A common underlying theme is uncertainty and doubt concerning whether one may be responsible for harm to the infant (Abramowitz et al. 2003). In the same way as in OCD, some ritualized behaviors develop, repetitive checking in particular (Leckman et al. 1999).

The Fiske Hypothesis

Despite the common features, most cultural anthropologists do not consider individual and collective rituals in the same explanatory framework. A notable exception is Alan Fiske (Dulaney and Fiske 1994; Fiske and Haslam 1997), who reopened an issue famously framed by Sigmund Freud (1928, 1948) a long time ago. Freud had commented on the obvious similarities, in terms of repetition and compulsion, between individual obsessive compulsion and the prescriptions of religious ceremonies. Although Freud's general theory of neuroses would certainly provide an interpretation for some features of rituals, in particular the obsessive concern with purity and pollution, this remains implicit in his treatment of ritual, which concludes with the tantalizing observation that obsessive neurosis should be seen as a private cult and religion as a collective form of neurotic obsession (Freud 1948).¹ It does not, however, solve the question of why this type of behavior appears in either context.

Many features of collective rituals, beyond those emphasized by Freud, make the comparison tempting. First, collective rituals are often centered on themes related to potential danger. Second, a constant theme in collective rituals is that nonperformance is highly dangerous, although in many cases no coherent account is available. Third, the actions are highly scripted and there is a definite intuition that deviations from the script are dangerous. Fourth, the actions are highly repetitive and redundant. Fifth, the specific actions performed are divorced from their usual goals. So it would seem perverse to try to explain collective ritual without considering this and the other domains of ritualization as (clearly different) manifestations of a common set of cognitive processes.

Comparing hundreds of ritual sequences with clinical descriptions of OCD cases, Fiske and colleagues showed that

the same themes recur over and over again in both domains (Dulaney and Fiske 1994; Fiske and Haslam 1997). OCD-typical features that also enter into rituals include specific (lucky or unlucky) numbers, use of special colors, repetition of actions, measures to prevent harm, ordering and symmetry, stylized verbal expressions, washing, concern with contagion, and so forth (Fiske and Haslam 1997). Those thoughts and practices are “egodystonic” in personal rituals, perceived as unwanted, unpleasant, shameful, or irrational. But the very same thoughts and practices are socially approved in collective rituals.

To Fiske, the similarities and differences between individual and socially acquired rituals suggest that a specific human capacity to perform rituals, usually channeled toward socially approved contexts, becomes hyperactive in pathology (Fiske and Haslam 1997). In this view, humans developed a capacity to engage in coordinated social action and also developed a subset of this as a capacity for collective rituals. The capacity helps channel personal fears or doubt into culturally transmitted conceptual schemes, thereby making them shared and probably less anxiogenic. This is because rituals, at least during performance, seem to make environments simpler, more predictable, and more meaningful than ordinary action (Fiske and Haslam 1997).

In our view, the Fiske model provides some important elements of a general account of collective rituals—not least of which is the crucial comparison with the cognitive processes engaged in individual rituals. However, we also think the hypothesis may be less than parsimonious in terms of explaining ritualization in general.

Specifically, it seems difficult to postulate a general capacity for collective ritualized behavior. As far as cognitive processes are concerned, most aspects of collective ritual can be explained in terms of capacities documented in other, nonritual contexts. Collective rituals make use of scripted actions but so do recipes and other routinized behaviors (Abelson 1981; Zacks et al. 2001). They focus on security-related issues but so do many intrusive thoughts outside rituals (Rachman and de Silva 1978). Collective rituals engage low-level parsing of action, but that is also true of other circumstances (Lassiter et al. 2002). What is specific to ritual is the combination of all these elements in a process that remains to be explained.

A NEUROCOGNITIVE MODEL OF INDIVIDUAL RITUALIZED BEHAVIOR

On the basis of anthropological and neuropsychological evidence, we proposed elsewhere (Boyer and Liénard in press) a synthetic model of individual ritualized behavior that we can only summarize here. This comprises the following: (1) a description of the neurocognitive systems involved in individual ritualized behavior, derived from specific neuropsychological models (Saxena et al. 1998; Szechtman and Woody 2004); (2) a speculative description of the type of action-representation engaged by ritual prescriptions; and

(3) a description of the short- and long-term cognitive effects of ritualized behavior.

Potential Danger and Relevant Cognitive Systems

A variety of findings converge to suggest a specific system for dealing with potential danger in the brains of humans and many other mammal species (Szechtman and Woody 2004). We will call this the hazard-precaution system. Its neural correlates are distinct from those of fear-systems that respond to actual danger (LeDoux 2003). For humans as well as many other species, survival and reproductive success require not just avoidance of present danger but also detection of indirect clues for fitness threats. So it is not surprising to find that the human hazard-precaution system seems to be specifically focused on such recurrent threats as predation, intrusion by strangers, contamination, contagion, social offence, and harm to offspring (Szechtman and Woody 2004). The system does not seem to respond in the same way to more recent and actually far more dangerous stimuli such as tobacco or cars (Mathews et al. 2004). We call this system “hazard precaution” because it comprises both (1) some specific reaction to potential danger clues and (2) rudimentary descriptions of appropriate precautions, including avoidance (of other people), contact avoidance and disgust (against contamination), and attention to traces and indirect signals (against intrusion and predation).

Individual intrusive thoughts—pathological or not—are often focused on a small range of items and concepts connected to these evolutionary threats. Individual rituals—pathological or not—often include the range of appropriate reactions to these specific potential dangers (Mataix-Cols et al. 2005):

Thoughts about contamination and contagion trigger compulsions centered on washing and cleansing, as well as precautionary measures, such as protecting oneself from intrusive material by moving to a different place, avoiding contact, avoiding breathing, and so forth.

Thoughts about possible harm to one’s own offspring trigger fears of handling tools and utensils in a dangerous way, smothering or dropping the infant, and forgetting about the baby or losing it (particularly in stores and other public places) with predictable precautionary measures: constant monitoring or repeated checking.

Thoughts about possible acts that would offend or upset other people, resulting in social exclusion trigger a hyperactive monitoring of one’s own actions, in particular the minutiae of one’s own behavior, well beyond the “normal” limits. Another common feature is that people choose to avoid social contact lest they insult or assault others, which again is intuitively appropriate as a precautionary device.

Obviously, the workings of this system—and of other neurocognitive systems of this kind—are not accessible to conscious inspection. The systems’ hidden computations result in a specific level of anxiety (or absence thereof) and a heightened attention focused on particular objects

(features of a landscape that make predation possible, features of a body that make contagion likely, etc.), as well as the compulsion to engage in particular courses of action (washing, avoiding contact, checking one's surroundings repeatedly, etc.). Neurocognitive models explain OCD pathology as a form of hyperactivation of this system (Szechtman and Woody 2004). In our view, nonpathological activation would explain compelling precautionary behaviors in many situations; it may also explain specific intrusive precaution-related thoughts at particular stages of the life cycle; children's ritualized behavior may correspond to a phase of calibration of this security-focused system (Boyer and Liénard in press).

Complex Ritual Rules and Working Memory

Another part of the model is a speculative explanation for the presence of complicated prescriptions. As we noted above, a hallmark of ritualized behavior is the activation of complex rules: Do *x* but not *y*, walk in a particular gait, handle an object in a particular way, and so on. The variations seem potentially infinite, but there is a recurrent feature in all these rules. They generally turn usually automatic or routinized behavior (walking, washing, getting dressed, etc.) into highly controlled action that requires sustained attention. An example is having to tie one's shoelaces three times on the right foot and four times on the left. The difference with simply tying one's shoelaces is that the latter can be done without attending to the action, whereas the former requires sustained focus.

Neuropsychologists have reported that some patients' compulsive rituals result in "swamping" of working memory, so that the person cannot attend to stimuli and situations outside the ritualized action (Ursu et al. 2003; Zalla et al. 2004). Also, many patients state that performing the ritual is one way of inhibiting or repressing unwanted thoughts (Salkovskis 1985). In our view, these facts legitimate the conjecture that complicated prescriptions may constitute a spontaneous and moderately efficient form of thought suppression, with some similarities to the suppression processes studied experimentally by psychologists (Wegner 1994; Wegner et al. 1987). In other words, patients with complicated compulsions spontaneously design a kind of activity so demanding in cognitive control that intrusive thoughts can be, at least for a while, pushed away from consciousness (Boyer and Liénard in press).

Ironic Outcomes

Finally, the model specifies that ritualized behavior has particular effects on the salience of the thoughts that elicited this form of behavior. Here we take inspiration from the study of voluntary thought suppression. Studying normal subjects instructed not to think about a particular item, Wegner showed that thought suppression typically results in a "rebound," a higher salience of the unwanted thoughts (Wegner and Schneider 2003). In Wegner's model, this is caused by the combination of two distinct processes

engaged in thought suppression. Although an explicit process directs and monitors the suppression, implicit processes are engaged that detect material associated with the target item (Wegner and Erskine 2003). Clinical models of OCD also concur in the conclusion that rituals often seem to exacerbate the obsession they temporarily appease (Rachman and de Silva 1978). The patients who perform more rituals are typically more anxious and also more bothered by their intrusive thoughts. The thoughts also seem to become more frequent with higher ritualization. In other words, the long-term effects of ritual performance may be the opposite of its short-term results.

A MODEL OF COLLECTIVE RITUALS

Our interpretation of ritualized behavior in collective ceremonies is not that these constitute individual rituals writ large, or even that they are generated in the same way as the individual compulsions described so far. Our model is based on cultural selection assumptions. We start from the premise that particular collective rituals are culturally successful (i.e., remembered by people and found compelling enough to perform again) to the extent that they activate specific individual neurocognitive systems more or more specifically than other possible variants. Specifically, we want to suggest that many details of collective rituals, when observed by normal human minds, activate the information-processing and motivation systems described above, which makes these behaviors attention-grabbing and compelling to participants, more so than alternates eliciting weaker operation of the hazard-precaution system.

Cognitive Capture of the Hazard-Precaution System

The hazard-precaution system only responds to information that is couched in a specific input format. This, in fact, is a general point that applies to many other functionally specific neural systems. Linguistic parsing systems, for instance, require words of a known language as an input; stereoscopic vision systems require slightly different retinal projections. To say that the hazard-precaution system requires a particular input format is simply a more specific way of saying that efficient information processing requires at least some filtering out of information, so that the system does not "fire" in each and every situation the organism faces, as this would be grossly maladaptive. The hazard-precaution system is activated by information about potential danger (in a narrow potential hazard repertoire) for which indirect clues can be found in the environment.

Another assumption is that any functional system with a specific input format is vulnerable to cognitive capture—that is, activation by signals that are not part of its intrinsic functional repertoire. There is a difference between the proper (evolutionary) domain and the (usu. broader) actual domains of a system (Sperber 1996). Mimicry and camouflage use this noncongruence between the functional domain and the actual domain of inputs that activate a system. Nonpoisonous butterflies evolve the same bright colors

as poisonous ones to avoid predation by birds. The proper (evolved) domain of the birds' bright-colored bug avoidance system is the set of poisonous insects, the actual domain is that of all insects that look like them (Sperber 1996).

Our contention is that many aspects of collective rituals activate the hazard-precaution system by including typical clues for relevant potential dangers. In other words witnessing or performing the prescribed actions should result in cognitive capture of the hazard-precaution system.

Information Available and Likely Inferences

To understand the cognitive effects of collective rituals, we must describe the kinds of information available to various people who participate in them. At first sight, it would seem that most people who participate in most rituals do not have much information at all. In most societies, they certainly do not seem to have an explicit, coherent justification for most aspects of the ritual, for the actions included or their sequencing. People do not generally hold a "theory" of their own rituals; this is what makes ethnography indispensable and difficult.

However, this is not to say that people participate in a ritual on the basis of mere imitation, peering at their cultural elders and simply performing similar gestures. This would be implausible, given that very little human communication actually involves such mindless imitation (Sperber 2000). Remember that conveying information about one's behavior does not necessarily imply explaining the behavior, explicitly commenting on it, or even having the deliberate intention of conveying it. All that is required is that some manifest behavior (including but not necessarily verbal behavior) triggers nonrandom inferences about the behavior. We propose that the information made manifest in connection with performance of a particular ritual consists of the following elements:

- *Available information about the background situation.* People are told that a ritual should be performed and led to infer that nonperformance is a dangerous option. For instance, one is told that because of a particular event (someone's illness, a death or a birth, the change of seasons, a war with another group, possible damnation), it is necessary to go through a particular ritual sequence. People also receive information and produce inferences about the kind of danger against which the ritual is supposed to protect the group ("pollution" by invisible substances, attacks by invisible predators like witches or spirits, threat of disease, possible famine, etc.) These themes substantially overlap with the potential hazard repertoire.
- *Available information about required course of action.* People are instructed to participate in the ritual in particular ways—that is, people are generally not allowed to just add to their ritual whatever action they think fit. They are enjoined, more or less explicitly, to follow a particular script. Information about the script has the following properties. First, action descriptions include themes

that mimic some of the typical outputs of the hazard-precaution system: actions such as cleansing, washing, and checking. Second, there is great emphasis on the details of each action, inducing what we called "low-level parsing" of the action flow above. This is made even more salient by insistence on repetition, redundancy, apparently pointless acts, and so forth. Third, descriptions of prior conditions for the ceremony (such as particular taboos, substances to avoid, etc.) reinforce activation of hazard-precaution system.

In the next pages we present some evidence for these various claims and for the psychological and cultural effects of the processes.

Recurrent Features of Collective Rituals and Cognitive Capture

Given the input format described above, various common features of collective rituals should trigger activation of the hazard-precaution system. This would be the case in particular of information concerning the occasion for the ritual, the danger of nonperformance, and the details of performance.

- *Occasion for the ritual.* The occasions for ritual often provide clues of possible danger that overlap with the potential hazard repertoire. This is quite clear in most apotropaic rituals, the explicit point of which is to prevent disasters to fitness such as famine or illness. But the same can be said of most therapeutic rituals, in the sense that the ultimate cause of illness is generally described in terms of nonobservable processes (from germs or miasma to witchcraft). Rites of passage also include such themes as removing pollution from newborn infants (as in baptism) or protecting people from the danger of indirect contact with corpses (Bloch and Parry 1982; Metcalf and Huntington 1991).
- *Danger of nonperformance.* This is a very general feature of collective rituals. In cases in which the goal of the ritual is very clearly specified (healing rituals for instance), the danger is also clearly specified. But this is not always the case for rituals—that is, most people develop the intuition that it would be really wrong and certainly dangerous not to perform a ritual without specific thoughts about what the risk is.
- *Detailed prescriptions.* Details of prescribed performance are of course the major source of security-related motifs. As we stated in our introduction, most rituals include such operations as washing and cleaning, checking and rechecking that a particular state of affairs really obtains, or creating a symmetrical or otherwise orderly environment. As we said above, Fiske and colleagues have documented these features extensively (Dulaney and Fiske 1994; Fiske and Haslam 1997), so we will not comment any further.

Our contention is that all these items of communicated information result in a weak activation of the hazard-precaution system. What we mean by that is that the

activation is probably (in most participants, in most rituals, most of the time) less intense and direct than in situations where people actually encounter clues for potential danger. The activation is bound to be weak because it is mostly indirect—from other people—and mostly through verbal communication. For instance, people are told that witches may be lurking near the village, but this is not the same as having the direct experience of seeing evidence of a predator's recent intrusion.

Consequences: Action Representation in Collective Rituals

Activation of hazard-precaution systems may explain further characteristics of collective rituals, in particular the way participants represent the actions they perform and their connection to possible goals.

- *Forcing goal demotion.* Ritual prescriptions seem to resort to particular “tricks” to make actions attention grabbing. Among these features are repetition, which creates action chunks but without the goal ascription that is usually associated with natural breakpoints in action flow. Another such device, obviously, is to borrow a sequence from ordinary scripts and perform it in a context that makes goal ascription impossible, (wash objects without using water, pretend to trace an imaginary line, etc.). What results from these “tricks” is what we called “goal demotion” above. Attention is focused on the low-level, fine-grained description of action, so that sequences of actions are represented without attaching a goal to each behavioral unit, as would be the case in nonritual contexts. This may be why the phenomenology of collective ritual is sometimes described as analogous to a behavioral “tunnel” in which the only action considered is the one that will follow the present one, but one does not and cannot focus on the motives of each action and especially not on possible alternatives (Bloch 1974).
- *Swamping of working memory.* Many ritual prescriptions resemble the tasks designed by cognitive psychologists in the study of working memory. They require focused attention on a set of different stimuli and their arrangement. For instance, a requirement to turn round a ritual pole three times clockwise without ever looking down imposes executive control of two tasks at the same time. Generally, the frequent combination of a positive prescription (“do x”) and a negative one (“while avoiding doing y”) would seem to engage working memory and executive control in a way that is not usually present in everyday action flow. The combinations of positive and negative prescriptions generally make it difficult to perform actions by engaging automatic routines. For instance, in everyday contexts one can tie one's shoelaces in a fairly automatic way; if, however, one adds the requirement that the laces should at no point touch the front of the shoe or that the fingers should never touch the sole, this imposes a high degree of attention and disengagement of routinized action patterns. Although

rituals can become routinized, especially for ritual specialists who perform them repeatedly, the focus on details of action precludes automatized performance.

COLLECTIVE RITUALS IN CULTURAL TRANSMISSION

So far we discussed the psychological underpinnings of collective ritual in terms of individual responses to socially transmitted rituals. If accepted as (provisionally and roughly) valid, the model would seem to raise the question, why are collective rituals so organized? Where and what is the engineering process that made them so effective in terms of creating conceptual associations and motivation?

Transmission: Relevance and Selection

Collective rituals are generally not “engineered” in the sense of a deliberate process. In our model, scripts for collective ceremonies enjoy a transmission advantage, to the extent that they include ritualized behavior as described here—that is, they include enough hazard-precaution cues to activate the relevant systems by cognitive capture. This obviously does not imply that anyone is deliberately including such themes in collective rituals; it only suggests that variants of the collective rituals that do include them should, all else being equal, be more attention grabbing and compelling than variants that do not, and therefore they should be potentially better transmitted. This raises the questions, how much activation of the system is necessary? and is it really the case that all participants share this orientation toward the ritual ceremony?

The model only predicts a potential activation of the hazard-precaution system—that is to say, we are not stating that participation in collective rituals invariably triggers full activation of the relevant circuitry. What we are saying is that collective rituals with the kind of prescribed actions described here are, all else being equal, more likely to result in some activation of these systems than ceremonies that do not include these specific kinds of prescriptions (turning automatic action into controlled action) and these specific themes (potential danger, pollution, etc.). We are furthermore saying that this potential difference would ensure the cultural prevalence of the kind of collective ceremonies we have described here.

This does not mean that ritual's success rests on such activation at every occurrence of the ritual in all individual. Our argument is probabilistic and not determinist. What we are saying is that normal minds that process the cues contained in ritual recipes are unlikely to treat them as straightforward false alarms. An efficient hazard-precaution system should probably be slightly oversensitive, and therefore prey to the kind of cognitive capture described here. In collective ritual, people's insistence on the potential danger of not following the rules—expressed as moral reprimand (moral threat), as possible exposure to gossip or ridicule (threat of social exclusion), or as worry about misfortune—is very likely to activate the hazard-precaution system.

Turning to individual differences, a model that derives cultural transmission from individual cognitive effects must address how these effects are spread among the participants (McCauley and Lawson 2002). Nothing in our probabilistic model of cultural transmission requires that the hazard-precaution systems are engaged in all participants. It is enough that such conceptual associations occur in some participants on some occasions. Indeed, it would be unreasonable to expect identical reactions to the available information. First, many participants do not seem to participate very much, as it were, and in fact do not accomplish much in the way of actions described here as ritualized behavior. Some may be attentive to the ritual prescriptions (e.g., making sure they pass the sacrificial objects clockwise, only using their left hand) whereas others just play the thing by ear, as it were, until corrected by others. Second, in most collective rituals different roles are assigned to different categories of participants (men vs. women, old vs. young, agnate vs. maternal kin, etc.). Indeed, in many cases participants from these different categories may have substantially different views of what is going on in the ritual. These differences in perspective may be essential to the attention-grabbing potential as well as the dynamics and transmission of some collective rituals (Houseman 2002; Houseman and Severi 1998). Here we must leave aside this important question, as it is essentially orthogonal to our transmission claim.

In cultural transmission, as in other descent-and-modification models, very small effects aggregated over many cycles of transmission are sufficient to create massive trends. That is, even in the (probably rare) limiting case in which few people produce inferences about hazard-precaution systems, the fact that they do and that no other equally salient template for understanding the collective ritual is available should result in a slightly better transmission of hazard-precaution themes over other ones.

Implications: Ritualization as the Opposite of Routinization

In this model, ritualized behavior is described as quite different from routinized action; indeed, it is conceived as its opposite. The point should be emphasized as the two are usually confused in the theoretical literature on ritual. As a result, theories of ritual handle these two very different kinds of behavior as if they originated in the same capacities or processes, which may contribute to the vagueness of many pronouncements on “ritual” in general. In most human ceremonies, one finds an alternation or combination of what we defined as ritualized behavior (high control, attentional focus, explicit emphasis on proper performance) and routinized action (possible automaticity, low attentional demands, lesser emphasis on proper performance). Differences in attentional focus in particular show that these are diametrical ways of regulating behavior. Note, again, that sometimes the same episode that is ritualized behavior for a participant (e.g., a novice about to be inducted into a secret society) may eventually become somewhat

routinized for another (e.g., the long-time member who has witnessed dozens of such ceremonies, or the ritual officer who has conducted them).

Previous cognitive models of ritual have emphasized differences that are relevant to this issue of routinization versus ritualization. The action-representation model of religious ritual (Lawson and McCauley 1990) predicts a fundamental difference between high- and low-intensity rituals. In the model, this is connected with participants’ assumptions about the ways in which superhuman agents are involved in the ritual, as agents or patients respectively. Harvey Whitehouse put forward a similar distinction between what he called distinct “modes of religiosity”: an imagistic mode that requires rare and salient events versus a doctrinal or routinized mode that emphasizes repetition conceptual consistency (Whitehouse 2000, 2004).

In our view, a fundamental difference that may be of greater impact on cultural transmission is that between the two behavioral modes described here, ritualization and routinization respectively, defined in modes of attentional focus and the division of the action flow. As we emphasized, the two modes can be found in the same series of ceremonies or indeed in the same episode as performed by different participants. So the distinct kinds of perspectives on the prescribed behavior, with their consequences on conceptual associations, can be found inside each ritual or religious tradition. Again, we must leave for further empirical investigation the question, whether this view explains cultural transmission more precisely than the distinctions between kinds of traditions or kinds of rituals put forward in other models.

COLLECTIVE RITUALS IN HUMAN EVOLUTION

Adaptation or Recruitment of Other Adaptations?

Is there a general human capacity for collective rituals, as a product of evolution by natural selection? Some features of ritual seem to cry out for such an interpretation. Some form of ritual is found in all human groups. Also, we can infer distinct features of ritualization from the archaeological record, especially in burial procedures, for the earliest modern human groups and for Neanderthals (Mithen 1996; Trinkaus et al. 1993). Moreover, human ritual is sufficiently different from its phylogenetic cousins in animal behavior to suggest a specific human adaptation. Seeing collective ritual in the light of evolution makes even more sense once we consider its connection to security motivation, the restricted range of concerns that intrusive and anxious thoughts focus on, as well as the restricted range of compulsive responses.

However, we consider the hypothesis of a specific capacity for rituals fraught with difficulties. To be evolved through natural selection, a capacity for rituals should be beneficial to individual reproductive potential. Or, more specifically, one would need to consider that a higher or more focused involvement in ritual performance would result, on average, in better reproductive potential. One

possible explanation would be that ritual is a good “trick” that associates individual, unmanageable anxieties with coordinated action with others and thereby makes them more tolerable or meaningful. But, again, it seems to us that we have very little direct evidence for the reproductive benefit of such a tool. Even though excessive anxiety may be maladaptive, anxiety in general is not. Indeed, evolutionary anthropologists have noted that most anxiety states seem functional rather than dysfunctional in terms of individual fitness (Nesse 1998, 1999).

Atavistic Procedures or Evolved Precautions?

In our model the rituals themselves are not the direct expression of an atavistic behavioral repertoire. Washing incessantly or spending all one’s time checking the environment for intruders probably are not evolved behaviors. Rather, the rituals combine, repeat, and accumulate single behaviors (avoiding contact with certain items, checking the environment for possible traces of intrusion, washing, etc.) that are appropriate given evolutionary hazards.

The ritualization process consists in this special accumulation and distortion of originally appropriate actions. This is manifest in animal models of the condition. Henry Szechtman and colleagues observed a high rate of repetitive and pointless “ritualistic” behavior in rats treated with quinpirole (a dopamine agonist, potentially acting on some of the neurotransmitter circuits involved in OCD pathology), in comparison to controls (Szechtman et al. 1998). The animals checked and rechecked particular locations and kept inspecting the same objects. The effect of test treatment was the higher recurrence, repetition, and redundancy of actions that were all performed (but with greater flexibility and no redundancy) by controls. In other words, rats that are induced to “ritualize” combine in a new way typical components of the rat’s species-specific precautionary repertoire.

Capacity or Disposition?

We proposed that collective ritual is not necessarily the outcome of an adaptive capacity but may well be the predictable by-product of adaptive capacities. In our model a collective ritual typically activates the hazard-precaution system. Given this system and its input format, a pattern of interaction that activates them may well become attention demanding and intuitively compelling. This would make ritual a by-product of evolved cognitive architecture. We are confident that this is a valid description of many of the behavioral sequences ordinarily described as “rituals” in the anthropological literature. However, as we noted above, particular rituals may or may not comprise ritualized behavior, characterized as the evocation of evolutionary danger cues, the construction of appropriate action sequences, and the association of goal demotion and precaution cues.

In this view, rituals can be considered highly successful cultural “gadgets” whose recurrence in cultural evolution is a function of (1) how easily they are comprehended by

witnesses and (2) how deeply they trigger activation of motivation systems and cognitive processes that are present in humans for other evolutionary reasons. To say that a cultural creation is a “gadget” does not entail that it is unimportant. Many of the most important human cultural creations—such as literature, complex technology, music, or the visual arts—can be considered as by-products too. For us, ritualized behaviors are another by-product of a species-specific human cognitive architecture and therefore an indirect consequence of its evolution by natural selection.

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1. Here is Freud’s conclusion: “Nach diesen Analogien [...] könnte man sich getrauen, die Zwangsneurose als pathologisches Gegenstück zur Religionsbildung aufzufassen, die Neurose als eine individuelle Religiosität, die Religion als eine universelle Zwangsneurose zu bezeichnen.” [“Given these analogies [...] it is possible to consider the obsessive-neurosis as the pathological counterpart to religious culture, and to see the neurosis as individual religiosity and religion as collective obsessive-neurosis”; Freud 1948:138.]

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