

## Introduction



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# Ritual explained: interdisciplinary answers to Tinbergen's four questions

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Convergent developments across social scientific disciplines provide evidence that rituals are a psychologically prepared and culturally inherited behavioural hallmark of our species. The dramatic diversity of ritual practices ranges from simple greetings to elaborate religious ceremonies, from the benign to life-threatening. Yet our scientific understanding of this core human trait remains limited. Explaining the universality, functionality and diversity of ritual requires insight from multiple disciplines. This special issue integrates research from anthropology, archaeology, biology, primatology, cognitive science, psychology, religious studies and demography to build an interdisciplinary account of ritual. The objective is to contribute to an integrative explanation of ritual by addressing Tinbergen's four key questions. These include answering ultimate questions about the (i) phylogeny and (ii) adaptive functions of ritual; and proximate questions about the (iii) mechanisms and (iv) ontogeny of ritual. The intersection of these four complementary lines of inquiry yields new avenues for theory and research into this fundamental aspect of the human condition, and in so doing, into the coevolution of cognition and culture.

This article is part of the theme issue 'Ritual renaissance: new insights into the most human of behaviours'.

## 1. Introduction

Rituals are universal practices of human culture. These ubiquitous socially stipulated conventions are such a pervasive part of everyday life that it is impossible to navigate sustained social exchanges without the knowledge of their local expression. A visit to a new country or region quickly reveals how critical rituals are for standard social interaction. For example, upon arrival at a *ryokan*, a Japanese inn, you will typically encounter a long line of shoes at the entryway. You will quickly slip off your shoes to add to the line, despite receiving no explicit instruction to do so. As you place your bare foot on the parlour floor, you will encounter a pair of house slippers or *uwabaki*. It will be apparent that wearing *uwabaki* inside the *ryokan* is expected; a glance around the room will reveal that everyone else is wearing them. When you arrive at your sleeping quarters, you will face no fewer than two additional pairs of *uwabaki*, one for the bedroom and one for the bathroom. You will dutifully transition to four different pairs of *uwabaki* throughout your stay, including when you are alone inside the bedroom, with no one to observe or correct you. Adopting the ritual footwear practices of this community signals to yourself and others that you are a member of this in-group and allows you to coordinate your footwear behaviour with others in the community. Ignorance of these behaviours risks ostracism and potentially violent reprisal, which underscores their vital importance to social functioning.

Rituals are socially stipulated, conventional behaviours. They are (i) pre-defined sequences of action characterized by rigidity, formality and repetition, which is (ii) embedded in systems of meaning and symbolism, and which (iii) contains non-instrumental elements that are causally opaque and goal

demoted [1]. The development of ritual studies as an independent and interdisciplinary area of scholarly study demonstrates the complexity of ritual as an analytical tool and as a universal human experience. For example, like Boyer & Lienard [2], Whitehouse & Lanman [3] argue for the ‘fractionating strategy’ for studying ritual. They propose that ‘Under this folk category [ritual] are numerous cognitively and behaviourally universal patterns that are normally associated with the term “ritual”, including such phenomena as synchronic movement, causally opaque action, and both euphoric and dysphoric arousal’ ([3], p. 675; see also [1]). Like similar trends in the study of religion [4], the fractionating strategy opens the door for a scientific account of how various phenomena normally associated with the folk term ‘ritual’ influence thought and behaviour.

The objective of this special issue is to bring together the social and biological sciences to provide answers to these questions by employing an integrative account of ritual that addresses Tinbergen’s four critical questions of animal behaviour. Namely, the papers in this special issue describe its phylogenetic evolutionary origins, its adaptive functions or useful purposes it serves, the specific psychological mechanisms involved in its performance and how it develops in individual lives. The issue thus yields the most comprehensive account to date of prevailing scientific approaches to understanding ritual and, in so doing, provides new explanatory insight into our understanding of a species that may be best labelled *Homo ritualis*.

Rituals are practiced daily by billions of people and have been a mainstay of culture over thousands of years of human history. Why do people spend time, resources and effort participating in behaviours like these? How do people think they work, and what is their function? Answering these questions requires uncovering the psychology of ritual. One approach is to examine times of transition, risk and uncertainty in the human lifespan. Consider the risks associated with giving birth and having babies—these constitute recurring problems to which rituals provide psychological and cultural solutions. For these reasons, the perinatal period is heavily ritualized [5]. The Indian birth ritual called *chhati*, widely performed among Hindu families to initiate new babies into the family and bring good fortune, is a good example:

Between 10 PM-midnight on the 6th day after birth, the mother should dress her infant in new clothes and light a lamp with a wick soaked in ghee. The lamp, a red pen, and blank paper should be placed on a wooden plank for *Vidhaata* (goddess of Destiny) to write the future of the newborn. The mother should hold the baby by the altar with photos or statues of gods and goddesses. There should be clean white handkerchiefs and extra pens so that after these items are blessed they can be used in future auspicious occasions. Red kumkum powder should be soaked with water to catch the baby’s footprints on a blank paper or cloth. (See <https://www.sanskarteaching.com/post/chhathi-na-lekh-sixth-day-after-birth> [6])

Rituals have social, psychological and instrumental functions. *Chhati* serves the social function of initiating babies into their families and communities. It has the beneficial psychological effects of reducing parental anxiety and increasing feelings of control over the health and safety of their infant. *Chhati* also serves the instrumental functions of protecting the infant from illness and attracting good fortune. Applying a scientific understanding of ritual to address problems of human social organization and change in this way has

the potential to revolutionize the efficacy and impact of behavioural interventions [5].

On the surface, there are astonishing differences between rituals associated with different populations over human history. They have been performed in populations living in different millennia, practicing different religions, and in those residing on opposite sides of the planet. They involve different substances, different practices and different artefacts. They also have different goals, such as treating illness, attracting a partner or predicting the future of a new baby. Yet there are also striking similarities. They include information about procedural repetition, multiple procedural steps, time specificity, high levels of procedural detail and commonly the presence of supernatural agents. They are among the most unique and defining behaviours of our species, yet they vary enormously within and between populations in content and kind. In this light, any account setting out to explain the human condition that ignores rituals, and the social and cognitive mechanisms that drive them, must be considered incomplete.

So where might we start? A causal account of ritual must explain its distinguishing characteristics. One is that rituals have important transmission properties—they are communicated both within communities (horizontal transmission) and across generations (vertical transmission). Second, they are cumulative. Cultures successively elaborate on handed-down rituals, building on their predecessor’s design (though notably, and perhaps critically, at rates that are glaringly incommensurate with other aspects of cumulative culture, such as technological change). Third, rituals are amazingly diverse, varying within and between communities. Humans seem to come equipped with the psychological capacity to engage in ritual. Rituals are a culturally inherited, behavioural trademark of our species. We thus propose that humans have a *universal ritual grammar* that is constrained with key defining properties, yet is sufficiently flexible to support the development of astonishing diversity. Humans come prepared to both learn rituals and to transmit them to others.

Cultural transmission is made possible by a set of cognitive adaptations that facilitate the acquisition and transmission of information within and across generations, such as biases for conformity and consensus, high-fidelity imitation and teaching [7]. These cognitive adaptations have evolved to understand the minds of others and to navigate complex social group behaviour. The social conventionality and causal opacity of rituals increase high-fidelity imitation and transmission and inhibit individual-level innovation [8]. Rituals are thus ideally suited to cultural transmission within and between generations over time. They are thus a byproduct of both cognitive and cultural evolution [9].

Rituals are often costly to the individuals participating in them. In some cases, they inflict psychological and physical harm, as in the harsh hazing rituals of some college fraternities and painful acts of religious devotion [10]. So why bother with them? One answer is that rituals have adaptive functions such as fitness benefits to health and reproduction [10–12]. Willingness to incur personal cost is a powerful and reliable signal to others that you are committed to the group. For example, dutifully attending religious education classes and memorizing prayers rather than seeking out more pleasurable activities signals to others that commitment to others is more important than one’s entertainment. Another answer is that rituals provide psychological and cultural solutions to critical problems

associated with group living [9,13]. For example, rituals may have other adaptive functions such as facilitating coordinated and cooperative group activities, one of the most cognitively complex challenges of group living. Practicing daily and weekly rituals in private and in public increases cooperation with others and contributes to community cohesion. As the size of human populations has grown from small groups of roughly 150 members to large geographically separated cities containing millions, rituals have allowed groups to remain cohesive, without the need for immediate physical proximity or familiarity. With the increases in non-kin, rituals can undergird group cohesion, while reducing the need for physical and social intimacy and proximity. For groups to maintain continuity and solidarity over time, there must be cognitive mechanisms in place that allow for the transmission of core beliefs, values and practices. Rituals may have additional adaptive functions such as binding group members together and reducing within-group conflict, thereby increasing the longevity of groups.

Consider the extraordinarily complex ritual cycle of pig slaughter enacted by the Tsembaga of New Guinea [14] as described by Legare & Watson-Jones [13, pp. 829–830]:

The ritual cycle revolves around periodic warfare between groups who compete over resources and retaliate over transgressions. Groups form alliances with extended kin networks to aid in battle. Rituals are performed before the beginning of warfare to inform the ancestors of the intention to fight. If an amicable agreement cannot be reached through negotiations and tensions escalate, ‘fighting stones’ are hung, indicating that debts to dead ancestors and living allies will be repaid as compensation for their support in the fight. The stones indicate that fighters must observe taboos against eating particular foods and engaging with members of the enemy group.

Two pigs are killed and cooked as offerings to the ancestors at the start of the ritual cycle. On the morning of the battle, the warriors consume one of the pigs, and taboos against engaging in social and sexual intercourse with women take effect. Men cover their bodies with the ash from the fire to encourage the spirits to ‘come into their heads where they burn, informants say, like fires, imbuing [the warriors] with strength, anger, and the desire for revenge’ ([14], p. 134). The black ash masks their faces, resulting in anonymity on the battlefield. Fighting may continue for weeks or months, but it is often interrupted by various ritual performances and mounting casualties.

Many of the characteristics of the Tsembaga ritual cycle contribute to high-fidelity transmission across generations. For example, fighting typically ends through a truce between the warring groups. After reaching a truce, warriors plant a rumbim (a local bush) and slaughter more pigs as an offering to their ancestors. Warriors remove the ash from their bodies and plant the rumbim. This collective action reinforces each individual’s connection to the group and the communal land. During the truce, debts to ancestors and allies are repaid and taboos remain in effect. The truce period typically remains in effect (and the rumbim remains in the ground) until there are enough pigs to sacrifice for the pig festival (kaiko). When there are sufficient pigs for the festival, the warriors uproot the rumbim and lift the taboos. During the yearlong pig festival, the Tsembaga host and give gifts to ally groups. During these visits, the men dance together in mass dances that last all night. The number of men from allied groups who come to dance indicates the amount of support the Tsembaga can anticipate in future fighting efforts. After the festival, more pigs are slaughtered. Ally groups are offered meat through a fence that the warriors ceremonially destroy after the kaiko [13].

Importantly, despite their presumptive waste of time, effort and resources, across cultures, and the historical record, rituals like the Tsembaga pig slaughter cycle are also widely used in

functional ways, such as avoiding harm [4] and promoting group cohesion and cooperation [15]. Records of rituals used for problem-solving purposes date back to ancient Egypt (*The Papyrus Ebers*). The use of rituals to tackle or solve problems as diverse in etiology as asthma and unemployment is widespread in contemporary cultural contexts such as the United Kingdom, the United States, India, Brazil and South Africa [16,17]. People use rituals to treat problems because they believe that they have the potential to have a causal effect. Consider what Brazilians call *simpatias*. *Simpatias* are remedial procedures or ‘recipes’ used to solve everyday problems such as asthma, infidelity and unemployment in Brazil:

To find a romantic partner: Buy a new sharp knife and stick it four times into a banana tree on June 12<sup>th</sup> at midnight. Catch the liquid that will drip from the plant’s wound on a crisp, white paper folded in two. The dripping liquid captured on the paper will form the letter of the name of your future partner [18, p. 87].

If you are unsure about how people think this works, you are in good company. The people who use *simpatias* can’t tell you (from a causal mechanistic perspective) how they work either [16,17]. The procedural detail is not a coincidence. Neither is the use of rituals for events relevant to important events in the life course. Rituals often have goals such as curing an illness, harming a rival, hoping for success in combat, or finding a romantic partner—outcomes critical for survival and reproductive success, that is increased fitness over human evolutionary history [19].

Even when people expect rituals to achieve a desired outcome, there is not always a direct causal connection between the actions and outcomes. Indeed, the ethnographic record is full of examples of rituals that cannot be explained in terms of physical causality [2]. Despite the elaborate and detailed nature of the rituals they practice, the Tsembaga do not explain, nor do they need to understand how their rituals work. When asked to explain their rituals they indicate that this is just how it is done in their group. Similarly, Brazilians who use *simpatias* cannot provide a causal mechanistic explanation for how their rituals work, and yet this does not deter them from using them. ‘How it has always been done’ in most cases means that ‘it has worked for a long time’, so its enduringness is a testament to its efficacy and robustness against change. It is ‘conservative’ in the best sense of the word—it conserves what has always worked (or at the very least appeared to work). Like most mutations, deviations or variations more typically lead to bad outcomes, and only occasionally to good outcomes.

Despite substantial psychological evidence for the early-developing capacity to reason causally, we often encounter behaviours that we wish to understand or interpret yet cannot explain from the perspective of physical causality. Reasoning about *causally opaque* events or outcomes—those lacking a known causal explanation—is a pervasive feature of human cognition. An analysis of rituals reveals a cognitive paradox: although widely used to solve problems, they lack causal mechanisms to explain their effects. This paradox raises an intriguing conceptual question: how should the perceived efficacy of ritual action be evaluated in the absence of causal information? Intuitive beliefs drive the use of rituals to solve problems about causality and the efficacy of goal-directed action sequences [16]. Observing intentional, goal-directed behaviour gives the impression that features of the action sequence have the potential to produce the intended outcome, even if the underlying

causal mechanism responsible for the outcome is imperceptible, supernatural or simply unknowable [1].

We hope the accounts of ritual detailed here highlight an increasing knowledge base, and the changing ways in which we are coming to interpret this core feature of what it means to be human. But this knowledge is also very much in its formative stages. Much more is needed. This special issue represents progress. Using Tinbergen's four critical questions of animal behaviour, in the following sections, we summarize the broad themes these contributions make.

## 2. Tinbergen question 1: evolutionary phylogeny of ritual

Is ritual a uniquely human behaviour or do other non-human animals engage in ritual? While it is important not to over-attribute human thinking and behaviour to other animals, the evolutionary roots of ritual probably run deep and are shared in part with other animals. Highlighting the challenges of deciphering the evolutionary origins of ritual behaviour we present two puzzlingly contrasting views: one sees traces of ritual behaviour in wild Guinea baboons [20] and white-faced capuchin monkeys [21]; whereas the other proposes an absence of evidence for any such traces in even our closest evolutionary cousins, the great apes [22,23]. These perspectives are complemented by a review of evidence from the archaeological record of ritual in archaic human history [24]. Combined, these contributions serve to highlight how challenging it is to search for evolutionary foundations of ritual and the importance of continued developments to establish shared definitions and research tools that permit cross-species comparisons.

## 3. Tinbergen question 2: functions of ritual

Papers in this issue draw upon evidence from the anthropological and evolutionary-science literature to explain the adaptive functions and roles of ritual in social group behaviour. Evolutionists distinguish between 'proper function' and 'usefulness'. By way of illustration, the nose is useful in holding up glasses on your face, but this is not the proper function of the nose or its shape. When approaching issues surrounding the function of a ritual, it is important to question whether it is likely proper or useful. The papers in this special issue do not always make this distinction, but we raise it here as something readers may wish to consider when developing their thoughts. Rituals may have a number of hypothesized adaptive functions associated with social groups [9,24], such as identifying group members, ensuring commitment to the group norm(s), facilitating cooperation with coalitions and maintaining group cohesion. Rituals serve as powerful signals and promote trust [15]. They can have psychological benefits such as reducing individual and collective anxieties [2,10].

Rituals also allow individuals to exert agency through action, giving the illusion of increased control that could also be related to emotional regulation and anxiety reduction [10] and may improve perceived health [12]. In this light, it is notable that Shaver *et al.* [11] propose that the frequency of ritual behaviour is tied to support for mothers, which in turn is positively related to number of offspring. Legare *et al.* [5] raise important questions about the ways a better

understanding of the rituals surrounding pregnancy, birth and infant care behaviour can be harnessed to improve health outcomes for women and children. Ritual may also increase arousal and anxiety, and then to reduce it, with this cycle resulting in an increase in bonding to the group (a hypothesized adaptive function).

## 4. Tinbergen question 3: mechanisms underlying ritual

Ritual may be a byproduct of a set of cognitive adaptations that facilitate the social transmission and acquisition of information within and across generations. For example, teaching, high-fidelity imitation and prosociality work in tandem to support cultural transmission [7]. Human social learning abilities are supported by a psychological system that has evolved to understand the minds of others and to navigate complex social group behaviour [8,24]. Well-documented cognitive biases reinforce the transmission of ritual, including preferences for similar others, and early-developing sensitivity to normativity, conformity, consensus and prestige.

The complexity and diversity of rituals are bound by both cognitive and socioecological constraints [10,12]. In this light, Singh *et al.* [12] report on interesting associations between participating in ritual and changes in both mental health and social cohesion, associations that differ depending on cultural context. Similarly, Lang *et al.* provide coverage of the possible evolutionary pathways of ritual's anxiolytic effects alongside experimental results from real-world rituals in Mauritius, and Gelfand *et al.* [25] take a targeted approach that explicitly examines one important aspect of ritual: synchrony. They report a trade-off, such that synchrony increases cohesion and coordination and decreases creativity and healthy dissent in groups. Intuitive beliefs about causality and the efficacy of goal-directed action sequences drive the use of rituals to treat problems. Watching intentional, goal-directed behaviour gives the impression that features of the action sequence have the potential to produce the intended outcome, even if the underlying causal mechanism responsible for the outcome is opaque [16].

## 5. Tinbergen question 4: ontogeny of ritual

Examining the development of ritual behaviour has implications for understanding the emergence of social group cognition in childhood as well as increasing our knowledge of the well-documented human tendency to prefer in-group members to out-group members. Wen *et al.* [15] explain that learning rituals are motivated by a drive to affiliate with social groups and provide a new theoretical foundation for understanding the ontogeny of ritual. They detail how the development of rituals is integral to understanding diverse elements of social group behaviour, including the achievement of coalitional goals, the experience of ostracism and the negotiation of social hierarchies. Over *et al.* [26] explore how rituals contribute to person perception and how by engaging in rituals, children learn to segregate their social world into those who appear trustworthy and those who do not, those who appear high in status and those who do not. These papers show how rituals function in the developing child, setting the pathway for how adults engage with them.

## 6. Conclusion: synthesis

Rituals are founded on adaptations to the challenges of group living and serve critical social functions. They also drive cultural transmission within and between generations, providing key insight into how information is transmitted and persevered. Although rituals have been widely studied by anthropologists, until very recently it has received relatively little theoretical and empirical attention from the biological and psychological sciences. Moreover, owing to the historical separation between anthropology and psychology, there has been limited interdisciplinary synthesis between disciplines about ritual. To date, attention integrating new insights about ritual across disciplines has thus been largely missing, ultimately resulting in limited scientific synthesis and progress in this area. This interdisciplinary special issue at the intersection of anthropology, evolutionary biology and cognitive science synthesizes cutting edge research on the phylogeny, function, mechanism and ontogeny of ritual.

Focused around Tinbergen's four questions, this issue is relevant to a wide range of biological and social scientific disciplines including evolutionary and cultural anthropology, animal behaviour and primatology, cognitive science,

psychology and religious studies. Depending on definition, a capacity for ritual behaviour may be in place in other primate species and in now extinct human species. They are certainly universal features of human culture, yet vary enormously within and between populations in form and kind. The papers we present describe and explain this breadth, universality and diversity by highlighting research using diverse human populations. This special issue thus increases our understanding of cognitive and cultural evolution, cultural transmission, social group cognition and behaviour and child development. This compendium draws attention to convergent developments in evolutionary biology, archaeology, primatology, cognitive science and anthropology that open up new directions for scientific research on ritual, and in so doing emphasizes how the study of ritual belongs at the forefront of attempts to understand the evolution of human cognition and culture.

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