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A U S T R A L I A

Ritual Cognition: Ritualized Action and Artefact

Rohan Kapitány

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Abstract

The following dissertation is an in-depth examination of the cognition and behaviour associated with ritualized action. Within the Cognitive Science of Religion (CSR) framework considerable resources have been devoted to understanding how rituals influence the way groups form, and how they influence the behaviour of individuals with respect to in- and out-group members (though other dimensions of ritual-related topics are discussed hereafter). However, as evinced by the publication record, very little effort has been devoted to understanding how we cognitively and behaviourally respond when rituals are directed towards objects and artefacts.

That this question has been overlooked is not a trivial academic matter. Rituals are ubiquitous across cultures, and while the vast majority of rituals are performed for the benefit of an individual or a group, a vast subset therein are performed toward objects, and thereby influence the way in which we interact with them. Wedding bands, birthday cakes, flags, holy water, and entire buildings (to name but a few) are all made unique via ritual action. What is it about such actions that bestow upon objects their status? Why and how does this come about? And can it be explained through wholly ordinary cognitive mechanisms?

In my introduction I outline the most relevant theories, which both inform and challenge our nascent understanding of object-directed rituals. I make suggestions as to which theories have the most promise in examining these questions. Further, I attempt to provide a theoretical and operational definition which is not merely a descriptive constellation of general features, but a definition which proposes a causal pathway of action. In so doing, I elevate the role of ‘causal opacity’ and ‘goal demotion’ to greater prominence (above featural qualities like repetition, redundancy, formality, and stereotypy). The following chapters sequentially present evidence for this definition, as well as exploring other important cognitive aspects associated with ritual cognition.

In chapter two I establish a robust protocol for examining the manner in which ritualized actions influence our cognitions. I challenge the methods and conclusions of prior work that has examined the role objects and artefacts play in ritual sequences. I examine predications made by the ‘ritual stance’, a theoretical framework for explaining ritual cognition, and find support for a nuanced picture of ritual cognition when ritualized actions are directed toward objects.

In chapter three I extend the findings of chapter two, and more clearly demarcate the unique role of goal demotion. I find support for the claim that causal opacity and goal demotion are separable, and account for different kinds of responses among participants. Further, I examine the ways our memory (and by extension, our perception) is influenced by ritualized action.

In chapter four I examine all previous findings in more ecologically valid settings. I examine the behaviour of children (in two distinct and orthogonal cultures) and adults. Here I find a distinct lack of support for predictions associated with the ritual stance, which represents a meaningful challenge to the validity of prior findings. However, I do find additional support for the position (established in chapter three) that ritualized actions are recalled/perceived differently from ordinary actions.

The results of these five experiments are discussed, and I attempt to reconcile these findings in a manner that can help direct future questions associated with object-directed rituals. While the results of these experiments were not strictly as hypothesized, they do provide an important definitional, theoretical, and operation foundation for future work on a topic that is otherwise under-researched.

Ritual Cognition: Ritualized Action and Artefact

Declaration by author

This thesis is composed of my original work, and contains no material previously published or written by another person except where due reference has been made in the text. I have clearly stated the contribution by others to jointly-authored works that I have included in my thesis..

I have clearly stated the contribution of others to my thesis as a whole, including statistical assistance, survey design, data analysis, significant technical procedures, professional editorial advice, and any other original research work used or reported in my thesis. The content of my thesis is the result of work I have carried out since the commencement of my research higher degree candidature and does not include a substantial part of work that has been submitted to qualify for the award of any other degree or diploma in any university or other tertiary institution. I have clearly stated which parts of my thesis, if any, have been submitted to qualify for another award..

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			Writing (10%)
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			Writing (90%)
		Mark Nielsen	Experiment Design (10%)
			Writing (10%)

Contributions by others

Associate Professor Mark Nielsen, my primary supervisor, influenced my thinking on theory, design/methods, and empirical analysis. Additionally, he reviewed and commented on (to the extent previously declared) chapters two and three prior to their respective publication dates. He provided feedback - specific to this dissertation - on chapter three, the introduction, and the conclusion..

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List of Abbreviations

CSR: Cognitive Science of Religion.

WEIRD: White, Educated, Industrial, Rich, and Democratic.

Introduction

Rituals, Religion, and Evolution

What comes to mind when considering ritual? Most often, the rituals we tend to be familiar with are the religious rituals associated with our own cultures. As a citizen of a first-world western nation in which the largest religious groups are Christian, I am most familiar with rituals associated with the beginning of life, the joining of lives, and the mourning of life lost (Baptisms, Marriages, and Funerals, respectively). While I do not belong to such religious groups I am also familiar with other rituals, including the taking of the sacrament, in which the devout remember their lord by way of consuming his body and blood, as well as less popular but still orthodox rituals associated with exorcisms and interventions (Herbermann, 1913). But to scratch the surface of ritual, to examine the constituent parts of it, is to be able to identify ritual acts outside of religion which are still unique to our own shared culture. One example is the birthday party: how odd it is to annually surround our loved ones, chant at them in unison, set fire to their dessert, then cheer with non-sense words like “hiphip” and “hooray” as they unhygienically extinguish the purposeless fire. What are the differences between an exorcism and a birthday? And perhaps more importantly *what are the similarities?*

A thorough and scientific examination of ritual requires one to ignore appeals to supernatural power in the former case and simple appeals to tradition in the latter. For if we take ritual acts at face value we must ask the questions *but how do those specific actions emancipate the possessed?* and *why does a birthday (and not a funeral or a wedding) warrant a flaming dessert?* These questions are, in a sense, absurd. There can be no scientific explanation or justification for either act. A more useful line of inquiry is to examine questions of proximal and ultimate causation (Scott-Phillips, Dickins, & West, 2011; Tinbergen, 1963). A proximal explanation is an explanation of what sustains a thing in the present, thus, to ask the following question of ritual has substantive value: *How do we recognize this act as something that is not ordinary?* or *why do we continue to perform rituals?* While an ultimate explanation relates to the causes that allowed a thing to come into being historically and ancestrally, thus we can

ask the question: *why does anything like a ritual exist at all?* To answer these questions we must divorce all the rich associations we may have with given rituals and examine the structure onto which such explanations are imposed. Thus we must forgo the exegetical explanations associated with supernatural intervention, as well as associations that a thing is *merely* transmitted culturally.

It is beyond the scope of this thesis to provide a full and complete theory of ritual and ritual cognition that satisfactorily describes the proximal features as they relate to causal mechanisms, the ontological and developmental considerations, as well as the ultimate features relating to the adaptive and functional utility of the act and the evolutionary and selective pressures that facilitated its emergence. While the pursuit of such a comprehensive goal might easily consume an entire lifetime, herein I take humble steps to address only a few of these features. In all empirical chapters hereafter, I begin to describe a range of behaviours associated with ritual and ritual cognition. In chapters one and two I attempt to demarcate some features of ritual cognition as causal mechanisms in our responses to, and our perceptions of, ritual. And in chapter three I propose and extend these findings into increasingly ecologically valid contexts, and contribute to the discussion of the ontological features of the human species that facilitate ritual-oriented behaviour.

How Should We Understand Rituals?

There are many possible scientific and academic frameworks that can illuminate the phenomena of ritual. Anthropological and sociological theories of ritual abound. Yet one of the more recent approaches to understanding ritual falls under the umbrella of the ‘Cognitive Science of Religion’ (CSR) (Atran, 2002; Boyer, 2001). This approach, broadly, suggests any explanation of religion and its features (including ritual) can be quantitatively and empirically investigated and explained with reference to ordinary cognitive faculties and heuristics. Further, such a framework is typically grounded by evolutionary theory. Where peculiar features of ritual (or religion more broadly) are identified a parsimonious approach is employed: the underlying ordinary cognitive

mechanisms of the phenomenon are identified, then discussed or manipulated in such a way as to elicit a response consistent with the initial *religious* observation (Boyer & Liénard, 2006; Liénard & Boyer, 2006; Sørensen, 2007b). For example, it has been shown that supernatural agents are present cross-culturally and tend to share a number of overlapping features. The underlying structure at the individual level is semantic memory, and it has been investigated and manipulated in such a way as to reveal that supernatural agents have a memory advantage because they incorporate a particular range and frequency of category violations (Banerjee, Haque, & Spelke, 2013; J. Barrett & Nyhof, 2001; Norenzayan, Atran, Faulkner, & Schaller, 2006). Descriptions of agents with a few deviations are better remembered than those with none, or those with too many. For example, a *man* (a category of thing with ordinary biological, psychological, and physical constraints) who is described as violating one of the native categorical constraints, such never needing to eat (a biological violation), knowing all the information in the world (a psychological violation), or being able to fly (a physical violation) is better remembered than a man who is all of those things (i.e., a know-it-all man, who flies from place to place, and who never hungers), or a man who is none of those things (i.e., just a man).

By and large this is an incredibly fruitful strategy for determining how and why something like ritual or religion can appear special, while being explained by wholly ordinary processes. To this end, specific theories of ritual cognition will be described in the following section (*‘What is Ritual Cognition’*). The logical consequence of the CSR approach, when applied to ritual, is that we must first consider ritual as a basically ordinary thing and that any cognitive or behavioural responses derived thereafter must be explained in terms of ordinary processes. This approach leads to interesting questions and insightful predictions. For example, we can consider a ritual - like any action - to be merely a structured set of motor actions requiring an understanding of causation and intention (Boyer & Liénard, 2006; Zacks, Kumar, Abrams, & Mehta, 2004; Zacks, Speer, Swallow, Braver, & Reynolds, 2007; Zacks & Tversky, 2001), which is further informed by contextual social information both implicit and explicit (Baldwin,

1992; Nielsen & Blank, 2011), and which is historically and cross-culturally present (i.e., not explained by local environmental or cultural factors; Nielsen, Mushin, Tomaselli, and Whiten (2014); Nielsen and Tomaselli (2010); Shipton and Nielsen (2015)).

But regarding ritual in this manner - as being like any other kind of action - is not particularly useful, and may even be counter-productive. Rituals do seem to elicit different kinds of thoughts and behaviours, and we must very clearly operationalize what features are present in rituals in order to determine why they are not ordinary. First, however, an important distinction (drawn from the literature) needs to be made. Thus far, I have been referring to the phenomenon under consideration as 'ritual' (and will do so in Chapter one), but what I am referring to - and what I will ultimately make conclusions with reference to - is 'ritualized behaviour' (a distinction not made clear until Chapter 2). The difference between ritual and ritualized behaviour is rather important. Rituals necessarily contain ritualized behaviour, but ritualized behaviour rarely constitutes a ritual in its entirety. Ritualized behaviours constitute the atomic elements of ritual - and can be recognized for the following features: *repetition* and *redundancy* of some or all actions, frequently also featuring *stereotypy*, in which the performance of such action is *rigidly* determined and highly *specified*, thus conveying a sense of *formality*, and which facilitates a drive to prioritize *accurate performance of the action* rather than accurate reproduction of outcomes. Such actions, when performed by a group, may also be *synchronized* (Bulbulia & Sosis, 2011; Cohen, Mundry, & Kirschner, 2013; Fischer, Callander, Reddish, & Bulbulia, 2013; Kapitány & Nielsen, 2015, 2016; Legare & Souza, 2012; Rappaport, 1999; Reddish, Bulbulia, & Fischer, 2014; Tunggenç & Cohen, 2016; Wiltermuth & Heath, 2009). In contrast, a ritual is a broader category of action: a ritual features ritualized actions, but also embodies *meaning and dogma*, arouses a diverse range of *emotions* (which likely serve important functional roles), and has various *learned associations and interactions with memory*, and which also tend to clearly '*belong*' to *specific groups and communities* (Durkheim & Ward Swain, 2008; Geertz, 1973; Whitehouse, 2004, 2012; Whitehouse & Laidlaw, 2004). This distinction should further the argument made earlier - that it is necessary

to separate religion from ritual (and, by extension, ritualized behaviour from ritual), particularly if the goal is to find answers to the questions posed previously: *How do we recognize this act as something that is not ordinary?*, and *why does anything like a ritual exist at all?*

I will argue over progressive chapters that the definition of ritualized behaviour (provided above) is actually insufficient. Consider the following thought experiment which I will continue to draw upon throughout this introduction. Imagine the room attendant of an upmarket hotel. The attendant's job is to clean recently vacated rooms. In so doing, the task is typically performed while the following conditions are met: the attendant is wearing an immaculate and standardized uniform (*formality*), they perform their obligatory actions (*rigidity*) during a *specific* window of opportunity. The attendant most likely enters the first room, and follows a reproducible set of procedures (first clean the bed, then the bathroom, then the floors, then the windows; *accurate performance of actions*). This attendant, by virtue of the prestige of the hotel, likely performs all these actions whether or not they actually need to be performed. If one of the beds has not been used it will nonetheless be cleaned (*redundancy*). And, of course, the very act of cleaning itself is highly *repetitive*. And this procedure will be repeated many times a day, every day of the week. The point is that many kinds of ordinary actions, with perfectly instrumental explanations, embody many of the features of ritualized behaviours. And yet, by any understanding - either in the lay sense, or a scientific sense - to conclude that the attendant's actions were a part of a ritual would be absurd (or at the very least useless). However, if you were to observe a formally dressed person who, at a specific time, entered the woods and appeared to - in specific order - douse, rub, and anoint the bark, branches, and leaves of a tree, then to repeat these actions on another tree, and another... you would be at a loss to describe that person as doing anything other than performing a ritual! The argument I will put forth in the following empirical chapters is that these features of ritual are only useful inasmuch as they generate *causal opacity* and *goal demotion*.

The role of causal opacity in ritualized action has been discussed by a number of

authors (Legare, Wen, Herrmann, & Whitehouse, 2015; Nielbo & Sørensen, 2016; Watson-Jones, Legare, Whitehouse, & Clegg, 2014; Wen, Herrmann, & Legare, 2015; ?). It has generally been described in two different ways, both of which have utility, and both of which relate to how an observer of an action can infer causal action. And yet, I will argue that both are insufficient and hereafter attempt to refine their definition and operationalization.

The first definition of causal opacity relates to actions which, when performed, do not produce physical outcomes. That is, the start-state of the object subjected to actions is equivalent to the end-state (as the actions have not physically causally altered the objects); this is referred to as ‘start-and-end-state equivalency’, and occurs when a “...[causally opaque] action sequence prompts the interpretation that the observed actions are unknowable from a physical-causal perspective...” (Legare, Whitehouse, Wen, & Herrmann, 2015; Watson-Jones et al., 2014). When actions do produce an end-state that perceptually varies from the start-state the actions are interpreted as having been performed in order to bring about the change, and the “... the action sequence is interpreted as having an instrumental goal and a potentially knowable causal structure” (Watson-Jones et al., 2014). These authors argue that as a consequence of state-end-state equivalency such actions are considered conventional by observers. This can be a useful claim to make under some circumstances, and I characterize causal opacity according to this definition as ‘actions that do not cause outcomes’. While some rituals and actions conform to this definition, others do not. Consider the following example in which this interpretation is incredibly useful: the act of clapping or giving applause. The pre-clap state of the universe is not physically different from the post-clap state of the universe, and as a result the actions are easily and justifiably interpreted as conventional. However, some rituals that feature causally opaque ritualized actions have a non-equivalent start- and end-state. Consider a birthday party. The person for whom the party is held is aware that there are lit candles on a cake (start-state), and who then has the obligation of extinguishing them (end-state). While the causal mechanism of extinguishing candles is easily knowable, the physical-causal

relationship between the extinguishing of the candles and the birthday itself is not, despite the fact that the start-state and the end-state vary from the perspective of the guest of honour. More extreme examples include ritualistic tattooing, circumcision, or scarification (Sosis, Kress, & Boster, 2007), where the end-start is permanently and physically different from start state. Thus, the notion that start-end-state equivalency is sufficient for arousing causal opacity is clearly lacking. Indeed, this definition also leaves open the possibility that, even if we accept it at face-value, it may be possible for ritualized actions to lead to an inference of *non-physical* change. In chapters one, two, and three I address additional problematic aspects of this definition of causal opacity.

The second definition of causal opacity relates to more concrete perceptual cognitive processes, and can be described as “... *the decoupling of an action sequence’s causal dependency structure*” (Schjødt & Sørensen, 2013). This definition describes how the causal pathway of a ritualized action and the corresponding [alleged] outcome is inaccessible to the observer. “... *[causal opacity] belongs to the level of concrete psycho-physics of an action, which is accessed through mechanisms of perceptual causality and therefore quite early in the processing hierarchy of dynamic stimuli*” (Schjødt & Sørensen, 2013). Such a definition allows for non-equivalence between start- and end-states, so long as the way in which the states change is perceptually unclear. The utility of this definition is that it allows for a difference between start- and end-states, real physical differences and does not preclude non-physical changes taking place (as will be discussed in chapters one, two, and three). While I use the first definition of causal opacity in Chapter one, as my understanding of the topic changed over time, I shifted towards the second in chapter two and three.

But causal opacity is not the only quality associated with ritualized action. I argue that *goal demotion* is equally important but relatively understudied. While goal demotion is mentioned as a quality of ritual by a number of authors (Boyer & Liénard, 2006; Legare & Souza, 2012; Liénard & Boyer, 2006; Rossano, 2012; Schjødt & Sørensen, 2013; Sørensen & Nielbo, 2013), very few have studied it empirically (but see: Fux, Eilam, Mort, Keren, and Lawson (2013); Mitkidis, Liénard, Nielbo, and Sørensen

(2014); Nielbo and Sørensen (2011). Many authors acknowledge the importance of goal demotion and suggest that identifying goal demotion is a function of the fact that ritualized actions “...are not justified by the purported goals of the performed sequences of action” (Mitkidis et al., 2014; Rappaport, 1999), or as a “*disturbance of the goal structure ... and [or] removal of the goal*” (Nielbo & Sørensen, 2011). Here I argue that these definitions are not distinct enough from that of causal opacity. If there is start-end-state equivalency then of course the actions are not justified by the goal, since the goal is simply not apparent (beyond the fact that actions were purposeful). Likewise, if an action sequence’s causal dependency structure is disrupted, then it is also the case that the goal structure is disturbed. In chapter two I describe the difference between causal opacity and goal demotion in the following way: “...*causal opacity describes whether or not an action sequence has an observable potential mechanism, [while] goal demotion refers to an observer’s ability to infer and understand an actor’s reason (e.g., goals or motivations) for a given action sequence*”. I further suggest that the difference is that “*causal opacity begets the question “By what mechanism is an effect being caused?” while goal demotion begets “Why does the actor act?”*”. Rituals tend to be both opaque and goal demoted, and as a result are rarely dissociated in the literature. In Chapter two and three I attempt to rectify this problem empirically by explicitly manipulating whether participants have access to actor’s intentions during the performance of ritualized actions.

So how should we formulate an empirical understanding of rituals? First, we should limit our investigation to ritualized action rather than rituals. Rituals feature ritualized action, but they also come with many other associations. By choosing (potentially arbitrarily, for ritual has many other features, too) to focus on this one building block, we can begin constructing from the ground up a more refined empirical understanding of the constitutional nature of rituals. Second, the consensus definition specifies that ritual and ritualized actions are recognized for their *repetition* and *redundancy* of some or all parts, in which the sequence of may also feature *stereotypy*, and in which the performance of such action is *rigidly* determined and highly *specified*,

thus conveying a sense of *formality*, which facilitates a drive to prioritize (when performing a ritual action) *accurate performance of the action* rather than accurate reproduction of outcomes. But as I articulate with the hotel attendant problem, such an operational definition is only useful inasmuch as those actions convey to observers a sense of causal opacity and goal demotion. In chapters one, two, and three I attempt to refine this theoretical approach with regard to understanding ritual cognition, and in so doing attempt to place all the motor-features of ritual, and the consequent normative-performative aspects of ritual, under the all-encompassing umbrella of causal opacity and goal demotion.

What is Ritual Cognition?

Ritual cognition is the study of ritual, typically from a psychological perspective. This is in contrast to approaches generally taken by anthropologists or theologians. Ritual cognition is an attempt to understand the features of mind (or populations of minds) that produce and/or comprehend rituals as distinct social phenomena. This area of enquiry generally adopts a CSR approach to the question, presupposing that rituals (and their constituent elements) are not special, but rather ordinary in their mechanisms (even if rituals do appear distinct from other kinds of social action). The following list outlines many topics associated with ritual cognition.

Topic within 'Ritual Cognition'

- Determining the stability of rituals within populations as a function of their features (Atkinson & Whitehouse, 2011; Fux et al., 2013; Henrich, 2009; Sosis & Ruffle, 2003; Whitehouse, 2001)
- The manner in which rituals influence the behaviour of individuals towards in-group and out-group members (Reddish et al., 2014; Ruffle & Sosis, 2007; Soler, 2012; Sosis & Ruffle, 2003; Wen et al., 2015; Whitehouse & Lanman, 2014; Wiltermuth & Heath, 2009; Xygalatas et al., 2013; ?)
- How rituals influence the identity of group members (Cheung & Chi-mei Li, 2011; Hermanowicz & Morgan, 2013; Legare & Wen, 2014; Mann, Feddes, Doosje, &

Fischer, 2016)

- The ways in which rituals interact with emotions and physiology (Bulbulia et al., 2013; Fischer et al., 2014; Konvalinka et al., 2011; Lang, Krátký, Shaver, Jerotijević, & Xygalatas, 2015; Norton & Gino, 2013; Zohar & Felz, 2001)
- The featural qualities determining efficacy of rituals (H. Barrett, 2002; J. Barrett & Lawson, 2001; Legare & Souza, 2012, 2014; Sørensen, 2007b; Sørensen, Liénard, & Feeny, 2006)
- Theoretical understanding of rituals as informed by biological/evolutionary theory (Atran & Henrich, 2010; Blute, 2006; Boyer & Liénard, 2006; Liénard & Boyer, 2006; Palmer & Pomianek, 2007; Purzycki & Sosis, 2013; Shaver & Sosis, 2014)
- The relationship between ritual, and learning and culture (Rossano, 2012; Wilks, Kapitány, & Nielsen, 2016)

However, the study of rituals as it relates to how we understand and interact with objects has received relatively little attention (Keren, Boyer, Mort, & Eilam, 2013; Vohs, Wang, Gino, & Norton, 2013), as has the study into how we actually *perceive* and *cognitively understand* rituals (Nielbo & Sørensen, 2011, 2016; Schjødt & Sørensen, 2013; Sørensen & Nielbo, 2013).

What follows hereafter is a discussion of a subset of theories as they relate to the empirical work that I will present. While many theoretical and methodological approaches are regrettably left without introduction, they have been omitted as they do not bear directly upon the work presented.

The ritual stance. The ritual stance proposes an explanation for individuals' responses when observing causally opaque actions (Herrmann, Legare, Harris, & Whitehouse, 2013; Legare & Herrmann, 2013; Legare, Whitehouse, et al., 2015) and was first developed in the context of children's imitative behaviour within a framework of cultural learning. The ritual stance is the claim that "*cultural learning in humans may involve a ritual stance (i.e., seeking out a rationale for actions based on social convention) in addition to an instrumental stance (i.e., seeking out a rationale for*

actions based on physical causation)” (Legare & Herrmann, 2013) and that “...*the rationale for interpreting an action [a ritualized action] is not in principle knowable from the perspective of physical causality and instead is based on social conventionality*” (Legare, Whitehouse, et al., 2015). The ritual stance may be triggered by causal opacity, as well as conventional language. While a conventional interpretation in the context of conventional language is unsurprising, the utility of the theory is that causal opacity begets an interpretation that these [causally opaque] actions are conventional and normative, and as a consequence, facilitates a conventional and normative behavioural response. But why? It is argued that [children] must learn to become competent members of their cultural communities, and in addition to acquiring instrumental skills (how to use particular technologies), they must develop an understanding of both ordinary conventional actions (such as handshaking, kissing, genuflections, etc.) as well as ritual conventions (such as marriages, funerals, birthdays, etc.) (Legare, Whitehouse, et al., 2015).

What does a conventional response look like? In Watson-Jones et al. (2014) and Legare, Wen, et al. (2015) ritual sequences (defined as “*conventions [that are] causally opaque, [and] socially shared*”, and which were operationalized as have start-end-state equivalency) elicited higher rates of imitative fidelity from children than did non-ritual sequences. Specifically, a demonstrator (presented in a video) sat in front of a peg-board, three blocks, and a sealed box (which concealed behind it a large block-like object). In the ritual condition (with start-end-state equivalency) the sequence involved the demonstrator picking up the blocks and tapping them against the board before placing them back into their original position. The demonstrator then pressed their fists together. This process was repeated twice. The third block was picked up and used to slide open the lid of the box, then this piece was returned to its original position, and the demonstrator closed the box with their hand. In the instrumental condition (where start- and end-states varied), rather than using the third block to open the box, the demonstrator revealed the previously concealed object and used it to open the box before placing it inside, before closing the box with her hand. The authors argue that

the ritual stance was activated in the ritual/conventional condition as there was start-end-state equivalency. They found, across three experiments, that there was a main-effect associated with end states, such that children imitated the demonstrated actions more accurately when there was equivalency than when there was not. They argue that because rituals (as conventions) can not be made more correct or efficient, the most appropriate way to reproduce them is as they were originally performed. A conventional response within this formulation of the ritual stance is, then, *‘to produce the ritualized action as exactly as possible when given the opportunity’*.

It is worth noting here that the manipulation employed may have been causally opaque to the extent that the actions performed provided no salient mechanism of action, but that because there was no change in states there was no actual mechanism that required discerning. Rather, these repetitive, redundant and formal actions were actually goal demoted, in the sense that it is unclear *why* the actor was performing the actions rather than *how* they were bringing about an effect.

Nielsen, Kapitány, and Elkins (2014) conducted two studies that better illuminate the role of causal opacity and goal demotion. In the first of two experiments, a child met an experimenter who introduced their favourite toy, played with it, then placed it inside a box. The first experimenter left and a second experimenter arrived, who retrieved the toy, then placed it inside a second, different, locked box. The second experimenter then demonstrated to the child how to retrieve the toy from the locked box with a standardized series of ritualized (repetitive, redundant) actions, and causally efficacious (but inefficient) actions. The second experimenter then, either a) left the room, b) remained in the room, or c) provided the child the opportunity to retrieve the toy immediately (by saying *“now it’s your turn”*). In the first two conditions, the first experimenter returned and asked the child *“... can you get my toy for me?”*. It was found that, as far as the reproduction of arbitrary actions goes, there was no difference between any of the three conditions. That is, the causally opaque actions (redundant, repetitive, formal) were copied despite the fact that there was not start-end-state equivalency (suggesting support for the definition of opacity that relates to disrupted

causal-dependency structures). Unlike the previous work, the actions were not goal demoted: the actor was apparently performing the actions in order to open the box. In a second experiment the procedure was repeated with three conditions. One condition involved the child responding directly after being shown the sequence (as per experiment one). The second and third conditions employed the same sequence of action and re-ordered the elements. The ritualized actions were moved to the end of the sequence after the box had been opened (the actions were both causally opaque - broadly conforming to both understandings of the term - as well as goal demoted: it was not clear why the actor was performing the actions because the apparent goal had been satisfied). In the second condition the child responded immediately, and in the third condition the experimenter left the room and the first experimenter returned and asked the child to help them get their toy out of the box. Reproduction of the arbitrary actions was highest when the sequence was causally opaque but not goal demoted (the sequence was not shuffled) and the child had a direct opportunity to perform the actions after demonstration. Reproduction was lowest when the sequence was causally opaque and goal demoted (with a shuffled sequence) and when the experimenter who demonstrated the actions (experimenter 2) was absent. However, even under these conditions - when the actions were causally opaque and goal demoted and the modeller of the actions would have no idea whether those actions were performed - reproduction of arbitrary actions was still evident! Suggesting, as predicted by the ritual stance, that causal opacity and goal demotion lead to conventional responses; that is, some children chose 'to produce the ritualized action as exactly as possible when given the opportunity'.

How is the ritual stance theory relevant to this thesis? First, it is primary theory under consideration, and has directly shaped each empirical chapter hereafter. This is primarily due to the fact that I think the ritual stance is underspecified. Within it the role of causal opacity and goal demotion is not clearly demarcated theoretically or operationally (addressed primarily in empirical chapters one and two). Second, conventional or normative behaviour is not always expressed through imitation or

copying, and, groups have various conventional expectations as they relate to objects. Thus, to the extent that the ritual stance makes the claim that ritualized actions arouse a conventional interpretation, such a claim should also apply to objects (this is explored in all three empirical chapters). Third, normative behaviour need not always be affiliative behaviour; the ritual stance does not specify how valence of actions influences perceptions and behaviour (explored in empirical chapter two). Fourth, the ritual stance is underspecified inasmuch as it makes no claims regarding how the ritual stance is activated from a perceptual or cognitive point of view (investigated in empirical chapter two and three). And Fifth, the ritual stance is claimed to be one route by which children become competent members of their communities as they age, and consequently, it is how they come to understand and appropriately respond to conventions and norms - such a claim ought to extend to objects subjected to rituals (empirical chapter three).

The Social-Action Hypothesis. The social-action hypothesis is introduced in chapter one and discussed extensively therein. The social-action hypothesis specifies that an observer's intuitions about ritual are constrained by ordinary cognitions and are cross culturally preserved (Lawson & McCauley, 1990; McCauley & Lawson, 2002). Further, it predicts that given minimal information regarding a ritual's structure, both in terms of the actions performed, as well as the objects and the agencies involved (Sørensen, 2007b; Sørensen et al., 2006), people can reliably develop intuitions about the efficacy of the ritual's efficacy. The logic of the social-action hypothesis is that, in worldly affairs, actions are often performed to rouse another to action, or arouse a change in their disposition. It's just that within a ritual structure this 'other' is super-natural. A further condition of the social-action hypothesis is that it weights each element of a ritual hierarchically (J. Barrett & Lawson, 2001; Lawson & McCauley, 1990; Sørensen, 2007a; Sørensen et al., 2006). Consider a real-world example: a religious marriage. To become married rings must be exchanged (objects), after the appropriate sermonizing and exchanging of vows (actions) under the authority of a Priest (an agent) who, himself, is authorized by God (a super-natural agent). The social-action hypothesis proposes the most heavily weighted factor in determining whether or not a

ritual is successful (for example, whether a marriage is authentic and binding) is, first, whether or not there is an appropriate super-natural agency presiding over the ritual, and second, whether the intentional agent is an appropriate conduit for expressing the super-natural agent's authority. The theory asserts that, because the mechanism of action is causally opaque (though they use different nomenclature), then the mechanism of causation is 'non-mechanistic, non-natural' and that *"even observers with little cultural knowledge of a particular religious system will still have intuitions that superhuman agency must be involved for the [ritual] action to work"* (J. Barrett & Lawson, 2001). By these intuitions, they argue that rituals are actions performed to influence the behaviour of super-natural others or to change their dispositions. As a result, rituals (and often, specifically, religious rituals) *must* have such an agency embedded within the structure of the ritual in order to persuade participants and observers that the actions *really will* cause an outcome. Due to the causal opacity of the actions employed, the only way to effectively rouse such a being to action is to have someone the being recognizes as their proxy. Thus, after the super-natural agent, the second largest contributor to perceptions of efficacy is the 'intentional agent' performing the ritual (a priest, for example, can't accidentally marry a couple). The social-action hypothesis simply takes the schemas associated with the perception of ordinary social acts, and intermingles super-natural agency as just another relevant social factor, albeit, within the context of ritual, it is argued to be the most important social factor.

The social-action hypothesis, and the empirical questions associated with it, have not been the subject of extensive investigation. In chapter one I critique this theory, and as such, will not go into further depth on the topic here. However, to summarise, the social-action hypothesis is not particularly divergent in the assumptions it makes about rituals. Much like the ritual stance, and the theories that will be discussed hereafter, it assumes that rituals can primarily be understood in terms of ordinary cognitions. Unlike the ritual stance, which supposes that by way of opaque actions rituals are identified as conventional or normative acts, the social-action hypothesis suggests that rituals are acts of persuasion, and that the inclusion of super-natural

agency is what makes them identifiable and efficacious.

The hazard precaution and Action Parsing system. The hazard precaution and action parsing system is discussed in detail in empirical chapter two, and is addressed again in chapter three. Proposed by Boyer and Liénard (2006) and Liénard and Boyer (2006) it can be described thusly: The underlying features of ritualized actions, which constitute a critical but not exclusive role in rituals more generally, can be explained by the conjunction of two specialized cognitive systems. The first is the ‘hazard and precaution system’ which governs our ability to infer whether there is a potential threat in our environment, and to respond in a protective or anticipatory manner. The second is the ‘action parsing system’, which governs how humans divide the flow of action sequences into meaningful units of action. Liénard and Boyer (2006) and Boyer and Liénard (2006) argue that these two cognitive systems can explain why rituals the world over tend to be constructed with the same core elements (repetition, redundancy, formality, stereotypy, etc.). The logical extension of this theory is that it provides both ultimate and ontological (developmental) explanations for rituals.

With respect to an evolutionary (ultimate) explanation of why rituals exist *at all*, the authors suggest that ritualized actions (often, but not always, in the service of larger rituals) are associated with specific themes cross-culturally, such as purity and cleanliness, contamination and health, reproduction, in-groups and kin, food and resources, and social harm. Such themes, they argue, are adaptive and represent evolved anticipatory-responses to selective pressures (see also: Abed and de Pauw (1999) for a discussion on the ‘psychological immune system’). If these themes were categorized super-ordinately and described under the umbrella of ‘safety’ (something too abstract to have been shaped by evolutionary pressures) we might see rituals associated with preventing car crashes or improving the efficacy of antibiotics, but we don’t. Further, we don’t tend to observe rituals in contexts that are not associated with evolutionary imperatives. We do not tend to observe rituals in the service of beauty as an abstract aesthetic quality, except when it serves as a proxy for reproduction; we do not tend to observe rituals in the service of mountains and rocks, unless those

mountains and rocks represent territory we claim as our own (and would fight to defend against others); and we do not observe rituals associated with melted-cheese on toast, unless it melted in such a way as to look like a first-century Jewish radical who claimed he can mitigate our culpability of social misdeeds¹. Liénard and Boyer (2006) argue that the limited range of ritual topics is due to the fact that the system is calibrated to infer the [potential] presence of real threats. For example, when we observe conspecifics actively eschewing particular foodstuffs it may indicate something about the value or danger of the food being avoided - as a consequential by-product, we observe food taboos in many religions (Meyer-Rochow, 2009); when we observe others assuming postures of supplication or submission it typically indicates the presence of a high-status individual or formidable enemy, thus, a reasonable course of anticipatory action is to treat the subject of such supplication cautiously - which may explain the stances assumed during prayer and worship (even if the other - a god or deity - is conspicuously absent); and to observe another cleaning an object is to proactively prevent the potential spread of contamination and avoid sickness as a result - thus, we find rituals that involve the repetitive cleaning and re-cleaning of objects in order to avoid a kind of *spiritual* contamination. Though it is worth noting that ritual and ritualized actions are not necessarily evolved: *“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... it seems to us that we have very little direct evidence for the reproductive benefit of such a tool”* (Liénard & Boyer, 2006). To the extent that the hazard and precaution system adaptively infers the presence of legitimate threats, ritualized actions tend to weakly ‘misidentify’ ritual actions as adaptively significant - a kind of evolutionary Type 1 error. As a result, this theory goes some distance to answering the question: *Why does anything like a ritual exist at all?* Answer: Ritual is the unintentional cognitive

¹see https://www.buzzfeed.com/arielknutson/people-who-found-jesus-in-their-food?utm_term=.pjlw1jRJ0m#.b1ZgQn2vR

by-catch of a system which helps us detect potential threats in our environment.

Ritualized action, and rituals, tend to be performed in a certain way: they are often compulsory or obligatory, they require high-fidelity reproduction of the script, and they are repetitive and redundant (Boyer & Liénard, 2006; Liénard & Boyer, 2006). But there are arguably good reasons for all of these things. Boyer and Liénard (2006) and Liénard and Boyer (2006) argue that rituals, much like instrumental ordinary action sequences, are necessary to avert or resolve a crisis. To the extent that failing to clean particular objects or supplicate at the correct time may result in anxiety associated with a potential sickness or insult, the production of ritualized action at the appropriate time can resolve anxiety associated with situations outside of our control. And there is empirical evidence to support this claim.

Norton and Gino (2013) examined how rituals were used by ordinary people after highly aversive events (such as the death of a loved one), and prompted them to consider rituals they participated in (or, as a control, asked them to consider an unrelated topic). Based on these retrospective reports, it was found that those who recalled a ritual after recalling a traumatic event reported more control and less grief than those who did not recall a ritual. Next (in two similar experiments), participants were brought into the lab and enrolled in a \$200 lottery. All but one lost the lottery and the remainder privately participated in a nonsense ritual, or engaged in a filler task. Those who engaged with the ritual reported more control and less grief associated with losing the lottery. In situations which are beyond our control and which arouse in us a sense of anxiety or loss, rituals appear ameliorative.

Similarly, Legare and Souza (2014) examined the perceptions of Americans and Brazilians under various conditions of priming where they induced a sense of randomness, negativity, or neutrality. Participants in the random condition rated descriptions of nonsense rituals as more efficacious than those in the negative or neutral conditions. With respect to the hazard precaution system, it follows that since some ordinary actions do adaptively allow for reliable inference of threat, that lead to adaptive and precautionary behaviours, then ritualized actions may co-opt this

sensibility and instil in observers and performers an imperative to produce such ritualized actions that mitigate anxiety associated the threat by providing or facilitating a sense of control. Thus, their production becomes increasingly obligatory as a tool for managing our emotions and our (subjective control over our) environment.

With respect to the necessity of high-fidelity reproduction of the script, since it is the case that causally opaque sequences can't really be innovated upon to improve their efficacy, there is no *better* or *best* way to perform a ritual, except to do it as it has been done before (Legare & Nielsen, 2015; Legare & Souza, 2012; Legare, Whitehouse, et al., 2015; Wen et al., 2015) - although that doesn't preclude certain features being more persuasive than others. And just because a series of actions doesn't have an immediate causal affordance (for example, reciting a specific number of *Ave Marias*), doesn't mean it is unknowable (Harrison, Roberts, Gabrielska, Rumbaugh, & Diggle, 2015) ²

Furthermore, some rituals require synchronized performance, and individual deviation outside of the expected set of action is likely to disrupt the proximal goal of synchrony (Cohen et al., 2013; Tunçgenç & Cohen, 2016; Wiltermuth & Heath, 2009). This expectation of adherence is likely related to features of repetition and redundancy. While it is the case that there is no better-or-best way to perform a causally opaque ritual (based on inferences of causality alone), it is the case that some features of ritual elicit higher ratings of efficacy than other features due to ordinary cognitive heuristics.

Legare and Souza (2012) showed that Brazilians and Americans identified some features of ritual as being more efficacious than others. Repetition, number of steps, and specificity of time were considered more efficacious than rituals without these features. Features such as number of items, specificity of place, edible (ingredients) and religious iconography did not influence ratings of efficacy. Put simply, it may be the

²When speaking on recreating and empirically testing an antibiotic treatment from a 1000 year old recipe, Mary McKennon said "there are remedies which require you to sing four Ave Marias, but then again, we should also remember this is a period when people do not have watches... everybody knows the length of an Ave Maria..." where the implication is that - whatever the proponents once believed - the technique may have been maintained for efficacious reasons unrelated to the expected causal relation (i.e., divine favour). See: <http://www.radiolab.org/story/best-medicine/>

case that ordinary cognitive heuristics underpinning folk-causation are being co-opted in the service of rituals: doing something *many times* is better than doing it *fewer times*, a *sophisticated* procedure is better than a *simple* one, and doing something at a *specific time* is better than doing it *any time*. Moreover, it doesn't necessarily hold that *eating* something is better than *not eating* something, or doing something *here* is better than doing something *there*. In instances of causally opaque ritualized actions, where the mechanism may not be known (but may be knowable), it is not possible to do the actions better than the way they were demonstrated, particularly if such actions are already co-opting ordinary cognitions in the service of faux-causation.

The hazard precaution system explains the logic behind our behavioural responses once the system is activated, but how does the system come to be activated in the first place? In empirical chapters two and three I discuss this in depth, but the thrust of the argument is that all the observable features of ritualized action (repetition, redundancy, formality, etc.) are in the service of generating causal opacity and forcing goal demotion. The hotel room attendant problem articulates this position in broad strokes, here, however, the logic of the action parsing system provides a cognitive foundation for these perceptions.

Humans, when observing the actions of others, parse the action sequences they observe into meaningful units and sub-units of information (Newtson, 1973; Nielbo & Sørensen, 2011, 2015; Zacks et al., 2004; Zacks & Tversky, 2001; Zacks, Tversky, & Iyer, 2001). For example, consider how meaningful the phrase 'to make a coffee' is. This spartan phrase conveys a great deal of information and intent. To make a coffee involves boiling water, retrieving the coffee tin, obtaining a spoon, opening the tin, using the spoon to collect coffee grains... and so on (not to mention the fact that 'boiling water', 'obtaining the coffee tin' and 'obtaining a spoon', all carry a great deal of motor information also). This is the study of partonomics, or 'action parsing'. Zacks et al. (2004); Zacks and Tversky (2001) and Zacks et al. (2001) argue that the action sequences we observe are partitioned hierarchically into schemata based on perceptual and functional information, and that this information is partitioned according to

achieving a hierarchy of goals. For example, the sub-goal of ‘putting coffee grains into a cup’ needs to be satisfied before realizing the larger goal of ‘making a hot coffee’. In this example ‘making a hot coffee’ is parsed as a *behaviour*, for it efficiently subsumes a great deal of (learned) information and pivots on the fact that we understand what the goal of that sequence of actions is (to produce a coffee; likewise, from the phrase and the inherent goal information therein, we can reverse engineer the actions and gestures required to produce the outcome). *Behaviour* is the default level of action-parsing, contingent upon our understanding of the causal processes and goals that bring about the end-state. *Gestures* are the sub-units of actions which make up behaviour, and appear to be guided by observers recognizing the hierarchical necessity of sub-goals. The *gestures* of ‘boiling water’ are a necessary component within the *behaviour* of ‘making a coffee’. This, of course, is somewhat dependent on our understanding of *schemas* or *scripts*. How we understand a series of actions and gestures depends upon our familiarity with them. While conducting research for Chapter three, I spent time among the Ni-Van on the island of Tanna in Vanuatu. Each evening the men and boys would retreat to the Nakamal (a cleared space in the jungle reserved for the men) to drink kava (a barely palatable concoction that brings about a range of effects from relaxation to stupor). To describe the behaviour associated with ‘making kava’ would not be informative to someone unfamiliar with the overall schema as would a description of the *gestures* involved: choosing appropriate kava root-stems, de-barking them with a knife, chewing them into pulp, spitting the pulp onto banana leaves, and filtering the pulp with water into coconut shells (not to mention this was only done at a specific time, in a specific place, by specific people; and that the manner of drinking was highly stipulated and formal, and the order regarding who drinks first was very important). While the behaviour of ‘making kava’ would initially be difficult to understand, a description of the *gestures* that constitute it, and with an accompanying causal and intentional understanding of how the goals of those gestures served to facilitate larger goals (to produce the kava drink) demonstrates the relationship between action units.

In observing action-sequences humans tend to perceive and recall action units via

top-down and bottom-up processes. Top-down processes are based on ‘knowledge structures’ of the event (Zacks et al., 2004). Consider the Hotel Attendant again. Our perception of those events would organize around our knowledge structures associated with cleaning: the repetitive, redundant, formal, and stereotyped actions would be understood with reference to the goal of ‘making the room clean’. Those same actions, performed in the forest, could not be understood based on existing knowledge structures, but rather, would be understood with regard to the features of the actions in a bottom-up manner: the attendant sprays mist in a pattern on the bark to remove it immediately with a cloth, they tickle the leaves with a feather duster, they replace sticks on the ground with identical looking alternatives. Further, the degree to which we demarcate action units may be built around the largest goal we can discern within the sequence (Zacks et al., 2004), particularly since we may be trying to actively construct an understanding of the actor’s intention on the fly (Wilder, 1978a, 1978b). Thus, we identify the goal of the sub-action as ‘spraying mist’ when directed toward a tree as we lack a larger behaviour to attribute it to, and yet the same action of ‘spraying mist’ when directed toward a mirror is identifiably in the service of ‘making the room clean’. Rituals, and ritualized action, are unique (as a general category of motor action) because they involve a great deal of redundancy, repetition, rigidity, formality, and so on. Under ordinary circumstances, the observation of a typical action sequence which involves various elements consistent with ritualized action (e.g., cleaning a bowl with a cloth) is parsed into units of action based on what we understand the actor’s intention to be (in this instance, to make the bowl clean). As a result the actions are parsed into quite large units: (1) he picked up a cloth, and (2) cleaned the bowl (or perhaps a typical description would omit (1) entirely). If one utilizes the features of ritualized action but disrupts the causal-dependency structure (such as, making a cleaning action toward of a bowl, but not bring the cloth and bowl into contact with each other) goal demotion is ‘forced’ on the observer as it becomes impossible to determine what the actor’s intentions are based on the causal structure and the outcome of the sequence. Additionally, the sub-units of action of shorter: (1) he picks up a cloth, (2) he picks up

a bowl, (3) he waves the cloth up and down near the bowl, (4) he puts the bowl and the cloth down).

Boyer and Liénard (2006) argue that “*rituals generally include action-sequences selected from ordinary goal-directed behaviour. But the context in which they are performed, or the manner of performance, results in “goal demotion” in performance divorced from observable goals*”. Ordinary actions, as described, are governed by top-down knowledge structures. This process is active, is contingent upon the observer’s goal, and is used to anticipate future actions (Land, 2009; Lassiter, Geers, Apple, & Beers, 2000). Boyer and Liénard (2006) and Schjødt and Sørensen (2013) see this as a key feature of ritual - one that ‘forces’ goal demotion’, Schjødt and Sørensen say “*the brain makes sense of the world by constantly generating predictive models. The brain generates predictions about the world (top-down models) which are continuously compared and updated according to input from the sensory apparatus (bottom-up models)*”. Thus, when observing ritualized actions which may be built around a very typical series of actions (e.g., cleaning a bowl), with associated top-down models and associated [actor] intentions, observations of actions that deviate from these models are surprising violations (e.g., failing to bring the cloth and the bowl into contact with each other, despite performing a cleaning motion). As a result, rather than continuing to parse the observed actions as *behaviours*, we are forced to parse them as *gestures*. In effect, these cognitively unexpected features disrupt existing causal relationships, emancipating and obscuring [our understanding of the actor’s] intentions from the action being performed. By doing something repetitively, redundantly, with apparently unnecessary formality and rigidity, we force a ‘goal demoted’ quality upon the sequence. The observer doesn’t have access to the inner state of the actor. And yet, because *behaviour* is the default level of action parsing, and because the process of observation is cognitively active, we are motivated to resolve our observations of these discrete *gestures* into *behaviours*: we want to restore goal information (Herrmann et al., 2013; Legare & Souza, 2012; Nielbo & Sørensen, 2015; Rossano, 2012; Schjødt & Sørensen, 2013; Sørensen & Nielbo, 2013).

Thus, we come to a point in which we can make sense of both the hazard precaution and action parsing hypotheses with respect to ritualized action. When we observe ordinary actions, we cognitively determine what effect is being caused and the process by which it is being caused. Additionally, we attribute an intention or goal to the actor performing the actions. If those actions fit a set of evolved criteria which imply that the actions being performed are in the service of preventing some potential environmental or social insult, we are motivated to respond. In the context of rituals, ritualized actions tend to disrupt our understanding of the actor's goals, in part because we are forced to parse actions as gestures rather than behaviours, and in part because the mechanism of causal action has been disrupted. In effect, ritualized actions bring about the quality of goal demotion and causal opacity. These ritualized actions may arouse in observers a motivation to act, as they trigger a system designed to identify threat outside the range of functional range of legitimate threat. The hazard precaution and action parsing hypotheses are discussed in chapters two and three.

Overimitation. Overimitation is not, strictly speaking, a part of the ritual cognition literature, but does share a considerable degree of theoretical and definitional overlap. Indeed, some authors argue that the cognitive systems and biases that predispose children to imitate are pivotal, not only for our acquisition of social norms and conventions, but for our understanding of rituals in later life (Atran & Henrich, 2010; Herrmann et al., 2013; Legare & Nielsen, 2015; Nielsen, Kapitány, & Elkins, 2014; Rossano, 2012; Wen et al., 2015; Wilks et al., 2016). Overimitation is the tendency for children and adults to copy the actions of a model even when those actions are inefficient, irrelevant, redundant, or do not cause an observable change of state (Horner & Whiten, 2005; Kenward, Karlsson, & Persson, 2011; Lyons, Young, & Keil, 2007; McGuigan, Whiten, Flynn, & Horner, 2007; Nielsen, 2006; Nielsen & Tomaselli, 2010). Furthermore, it seems to arise due to the observer's tendency to focus on the behaviour of the modeller, rather than on the outcomes the modeller brings about. And while there is some debate regarding the *how* and *why*, there is considerable evidence suggesting that this behaviour is primarily affiliative and normative (Horner & Whiten,

2005; Kenward et al., 2011; Nielsen & Blank, 2011). It is interesting to note that while overimitation was first observed in children (Horner & Whiten, 2005) and appears to emerge around 18-months (Nielsen, 2006), our tendency to overimitate increases as we get older, rather than decreases (McGuigan, Makinson, & Whiten, 2011; Whiten et al., 2016).

As much as the definition of overimitation appears on the face of it to be highly related to ritual cognitions an illustration of the paradigm is also useful. The classic overimitation task involves a short stick, and a box that is clear or opaque, inside of which is hidden a reward. This box is an approximate cube, and the top surface has two sliding-bolts obscuring an opening into the box. The bolts are easily manipulated by multiple methods. Inside this opening is a false bottom; the inside of the opening has no relationship with the rest of the box. The front of the box has a sliding door which is also mounted on a hinge (as such, participants can use one of two methods to reveal the chute behind the door). The stick is used to open the door by one method, then is thrust into the chute to retrieve a prize (often by way of velco or sticking-gum). The box itself can usually be opened very easily by opening/sliding the door by hand and retrieving the prize with the stick directly. However, experimentally, what transpires is an experimenter demonstrates in a pedagogical manner (i.e., “*now watch what I’m about to do*”; formality) to a participant a combination of relevant (but inefficient) actions, and irrelevant actions. For example, the stick is used to stoke the side of the box three times (repetitive, redundant actions), and is then used to slide the two bolts into an open position exposing an opening (relevant but inefficient). The stick is then held vertically and is used to tap through the opening into the box three times (repetitive, redundant actions). The stick is then used to slide/open the door (relevant, but inefficient), and is thrust into the chute to retrieve the prize (relevant, efficient) (Berl & Hewlett, 2015; Horner & Whiten, 2005; Lyons et al., 2007; McGuigan et al., 2007; Nielsen & Tomaselli, 2010). It should be noted that, one, fidelity between opaque and transparent boxes is typically compared and children copy the transparent box at extremely high rates (keeping in mind that transparency enhances the saliency of the

redundancy of many of the actions), and two, while this specific apparatus is widely used, any box with certain affordances, and an action sequence involving a combination of actions conforming to the description provided can be employed. In practice, overimitation is the study of our behavioural tendencies to copy at high-fidelity causally opaque and goal demoted actions, which are repetitive, redundant, stereotyped, (and frequently presented formally and pedagogically), in which the participant appears to prioritize performance of actions rather than outcomes.

The similarities between overimitation and ritual cognition are unlikely to be superficial. A considerable amount of research examining how rituals influence groups looks highly similar to overimitation paradigms. For example, Legare and colleagues frequently use a task that involves children observing a model creating a necklace which employs a mixture of relevant and irrelevant actions to achieve their goal (similar to those described above: repetitions, redundant, formality, etc.). Children then get the opportunity to make their own necklace, and the degree to which they reproduce the irrelevant/ritualistic actions is used to predict their subsequent affiliation with a group (Clegg & Legare, 2016a, 2016b; Legare & Wen, 2014; Legare, Wen, et al., 2015). Our understanding of overimitation is also consistent with the more robust theories of ritual cognition. Consider the ritual stance - that actions which are not easily interpreted through an instrumental lens are interpreted as socially stipulated conventional actions. This is not a considerable departure from our understanding of overimitation as motivated by normative and social concerns (Horner & Whiten, 2005; Kenward, 2012; Kenward et al., 2011; Nielsen & Blank, 2011). Nor is it that different from the hazard precaution hypothesis, in which the high-fidelity reproduction of actions are often felt to be obligatory by the observer (Kenward, 2012), even when they are repetitive and redundant. Indeed, I support the proposition (articulated in empirical Chapter two) that overimitation is likely an adaptive feature which emerges in childhood (Horner & Whiten, 2005; Legare & Nielsen, 2015) and is used to acquire and transmit social and cultural information early and efficiently (Rossano, 2012), and which facilitates group membership and belonging (Clegg & Legare, 2016a, 2016b; Legare & Wen, 2014;

Legare, Wen, et al., 2015). Explicit overimitation-type actions rarely occur ‘in the wild’, so to speak (consider the paradigms described) - but do occur frequently within cultural rituals: to the extent that overimitation may be adaptive in childhood, it may very well be adaptive in adulthood (Atran & Henrich, 2010; Henrich, 2009; Rossano, 2009).

While this thesis is not primarily concerned with supporting the link between overimitation and ritual cognition, I have been involved in research investigating this relationship previously (Nielsen, Kapitány, & Elkins, 2014; Wilks et al., 2016), and do touch on the relationship between development and ritual in chapter three.

On the Importance of a Cross-cultural and Developmental Theory of Ritual Cognition

The Cognitive Sciences of Religion explicitly investigates how religion (a cultural institution) can be explained by way of ordinary cognitions nested within an evolutionary framework. In the study of humans, an evolutionary framework encompasses both biological evolution, which encompasses the mind (H. Barrett, 2014), as well as the evolution of culture (a product of the mind). This has been described as the ‘dual inheritance’ model (Henrich & McElreath, 2007; Richerson & Boyd, 1978), and specifies that the selection pressures upon humans may be at a phenotypic optima in response to *cultural* selection pressures rather than biological selection pressures. However, empirical psychological science has a diversity problem, inasmuch as the populations studied to address evolutionary questions are often far too limited to draw generalizable conclusions (as cultural variation itself can be both an adaptation and a selection pressure; Laland (2001)); as Henrich, Heine, and Norenzayan (2010) put it “*Most people are not WEIRD*”, that is, most people are not *White, Educated, living in Industrialized, Rich, and Democratic* countries). While the tendency for those within the field of cognitive sciences of religion is to study far more diverse populations than other fields, which - in theory - allows for more generalizable conclusions, it is still the case that *any* psychological theory that aspires to universality *must* take into account *cultural considerations*, and *most* theories that claim to be evolutionary must consider

the trait's *development* (Mesoudi, 2011; Nielsen & Haun, 2016).

Approaches to the study of ritual cognition, including those discussed at length here, include those that are *explicitly* and theoretically evolutionary (as with the hazard precaution hypothesis), as well as those that are *implicitly* evolutionary (such as the ritual stance), and which are examined, in practice, in cross-cultural and developmental contexts (Clegg & Legare, 2016a; Wen et al., 2015). Further, theories that bear upon its study, such as overimitation, are studied very broadly across cultures and age-groups (see: (Nielsen, Mushin, et al., 2014; Nielsen, Mushin, Tomaselli, & Whiten, 2016; Nielsen & Tomaselli, 2010). Thus, if we consider the topic of ritual and ritualized behaviour as one worthy of investigation by virtue of its universality (Brown, 1991), then any theory that claims to explain it must have predictive power across cultures, and where appropriate (as is the case here) across development. Thus, in empirical chapter three I explicitly attempt to account for predictions built off chapter one and two in a developmental and cross-cultural context.

Methodological and Epistemological approaches in Ritual Cognition

During the period of my candidature I have attempted to take seriously my own methodological and epistemological craft. Evidence of commitment to improving empirical approaches can be broken down into three broad categories. The first relates to features of the stimuli, while the latter two relate to the present 'crisis in psychology' (Pashler & Wagenmakers, 2012), wherein I commit myself to pre-registration, and open science.

In chapter one I discuss how various empirical approaches may be insufficient, and propose how the use of videos is superior to vignettes. This point is explored in chapter one; what I do not discuss in depth, but actively pursued during chapter one (and for each chapter thereafter) is the use of diverse stimuli. Specifically, by operationalizing 'rituals' clearly, I was able to create three different sets of rituals (with corresponding matched control stimuli) in which each alone ought to have, theoretically, elicited the desired effect. I then collapsed all analyses across stimuli, and never reported or

attempted any analysis of differences between each instance in the set. While it may be possible that stimuli A is more effective at arousing hypothesis-consistent responses than stimuli B and C, it may not be the case that it is because stimuli A is ‘more ritualistic’ or theoretically appropriate. By conducting analyses across a range of stimuli I attempted to control for artefactual features, which consequently should serve to make my conclusions more conservative and theoretically appropriate.

The ‘Crisis in psychology’ describes an alarming rate of reported false positives in the published cannon. There are multiple potential causes for this, which include lack of replication (Earp & Trafimow, 2015; Pashler & Wagenmakers, 2012), post-hoc theorizing or HARKing (Kerr, 1998), underpowered studies (Maxwell, 2004), and a publication bias known as the file-drawer effect (Rosenthal, 1979), to name a few. I replicated several conditions across multiple experiments in an attempt to draw a very clear, linear and narrative thread between each experiment. For example, both experiments in chapter one share many features, and indeed, each experiment of chapter one shares two (of four) identical conditions. Likewise, chapter two shares two identical conditions with experiments in chapter one. Further, chapter three contains one condition conceptually identical to the two experiments from chapters one and two, but examined in a behavioural context. However, while the developmental study in chapter three is highly similar to preceding work, due to the demands of working with children in cross-cultural environments, some features were varied. Notable also is my commitment to open science and pre-registration. The data and syntax for Chapters one through three is currently publicly available on the Open Science Framework (OSF; www.OSF.io). Furthermore, the adult experiment in chapter three was pre-registered. However, in the spirit of improving my empirical craft, it is worth noting that Kapitány and Nielsen (2017) was fully pre-registered, as was Kapitány and Nielsen (n.d.).

Chapter One: Adopting the ritual stance: The role of opacity and context in ritual and everyday actions.

Kapitány, R., & Nielsen, M.

Preface

The present empirical chapter was first published in *Cognition* in 2015. It is presented without change (save for factual corrections that do not change the methods, results, or analysis in any way; as well as changes made to ensure consistent terminology). The purpose of the first experiment in this chapter was to falsify the initial claim that ritualized actions directed towards objects influenced the perception of the object. The purpose of the second experiment was to manipulate the valence of the social context in order to provide greater resolution on theoretical aspects of the ritual stance.

Abstract

Rituals are a pervasive and ubiquitous aspect of human culture, but when we naïvely observe an opaque set of ritual actions, how do we come to understand its significance? To investigate this, across two experiments we manipulated the degree to which actions were ritualistic or ordinary, and whether or not they were accompanied with context. In Experiment 1, 474 adult participants were presented with videos of novel rituals (causally opaque actions) or control actions (causally transparent) performed on a set of objects accompanied with neutral-valence written context. Experiment 2 presented the same video stimuli but with negative and aversive written context. In both experiments ritualized objects were rated as physically unchanged, but more ‘special’ and more ‘desirable’ than objects subjected to control actions, with context amplifying this effect. Results are discussed with reference to the ritual stance and the social-action hypothesis. Implications for both theories are discussed, as are methodological concerns regarding the empirical investigation of ritual cognition. We argue that causally opaque ritual actions guide the behaviour of naïve viewers because

such actions are perceived as socially normative, rather than with reference to supernatural intervention or causation.

Introduction

We routinely encounter rituals, in some form or another, in the course of our daily lives (Brown, 1991; Fiese et al., 2002; Helman, 1994). While we readily identify some behaviours as ritualistic, such as attending a religious service, we can fail to do so for others, like standing for a national anthem or celebrating a co-worker's birthday. There is evidence that our understanding of ritual emerges early and is built upon social concepts and idiosyncratic processes (Klavir & Leiser, 2002). But how do we know when a sequence of actions should be treated as ritualistic, as signifying meaning beyond the actual actions, and how does such recognition influence our behaviour, especially when we encounter a ritual for the first time and have little knowledge of its purpose, content, or associated rules? The aim of this research is to provide some answers to these questions.

The term 'ritual' is generally applied to a wide range of actions and behaviours. For the purposes of the current research we consider rituals to be a coherent series of actions characterized by formality, repetition, redundancy, stereotypy, and causal opacity, in which performance is more important than outcome, and little variability is permitted in the action's execution (Bulbulia & Sosis, 2011; Legare & Souza, 2012; Rappaport, 1999; Rossano, 2012). Causal Opacity, as argued by Watson-Jones et al. and Legare, Whitehouse, et al. (2015) is a key element of ritual, and is defined as a situation in which there is start-end-state equivalency, that is when an action sequence does not afford a discriminable difference in the pre-action (start-) state of an object/situation from the (end-) state. As observers cannot meaningfully interpret these actions as having caused a physical outcomes they are are, in effect, 'unknowable'. On the other hand, causal transparency results from a series of actions that are 'potentially knowable'; there is a meaningful, possible, physical-causal interpretation (and this interpretation is valid even if making an actual distinction between start-end-states is

not immediately possible). For example, singing the national anthem with one's hand across one's heart, features redundancy, formality, stereotypy, and causal opacity (there is no possible physical-causal outcome). However lighting candles on a birthday cake, while including redundancy, formality, and stereotypy, affords a possible, potentially knowable physical-causal outcome that results from the physical act of lighting candles.

Rituals serve a dual purpose: their first ostensible purpose is to control or influence the environment, to effect an outcome of a supernatural nature or by supernatural means, or to alter the symbolic aspects of people, places, or objects (Dawson, 1999; McCauley & Lawson, 2002; Sørensen, 2007b; Sørensen et al., 2006). The second purpose of a ritual typically concerns group relations, in which we bond ourselves with our in-group (Konvalinka et al., 2011; Reddish et al., 2014; Wiltermuth & Heath, 2009), demonstrate commitment to it and its values (Ensminger, 1997; Henrich, 2009; Irons, 2001; Ruffle & Sosis, 2007; Sosis & Ruffle, 2003), enforce norms upon group members (Atran & Henrich, 2010; Sosis & Bressler, 2003), or aid in the transmission of [cultural] information (Chudek & Henrich, 2011; Rossano, 2012; Schjødt & Sørensen, 2013). According to the ritual stance (Legare & Souza, 2012; Legare, Wen, et al., 2015; Legare, Whitehouse, et al., 2015; Nielsen, Kapitány, & Elkins, 2014) when we cannot easily understand the physical or causal significance of a ritual (due to the causal opacity of the act) we are motivated to generate an understanding built upon normative and social inference which subsequently influences our behaviour. That is, the cognitive mechanisms that are employed to understand ritual are mechanisms which help us navigate a wide range of social and normative information. The ritual stance, however, is one end of a continuum; the difference between opaque and transparent action is not easily discriminated by observing the actions alone, particularly by novices (Humphrey & Laidlaw, 1994; Stall, 1990; Whitehouse & Laidlaw, 2004). Social and contextual cues (independent of the action itself) can motivate observers to interpret the action instrumentally (i.e., according to the instrumental stance). For example, lighting candles then carrying them into a fully lit room may elicit a ritual interpretation, whereas lighting candles then carrying them into a fully darkened room

may elicit an instrumental interpretation. An alternative explanation regarding ritual understanding is the social-action hypothesis, which argues that rituals are performed (and regarded as effective or successful) when they are in the service of, or appeal to, supernatural agents; just as an ordinary act might be performed to influence the behaviour or disposition of a friend or other social agent, a ritual act is performed to influence the behaviour or disposition of a supernatural agent (J. Barrett & Lawson, 2001; McCauley & Lawson, 2002; Sørensen et al., 2006). Rituals are fundamentally motor actions which (occasionally) employ physical objects or tools; in such a light they may be considered similar to other forms of behaviour (Boyer & Liénard, 2006). When the purpose, motivation, or intended outcome of such actions are opaque, we typically find them salient and engaging in a way other actions are not; these actions result in ‘cognitive capture’. Ritualistic actions arrest attention by engaging cognitive ‘action parsing systems’, hijacking existing systems which are used to infer information about the actor or the environment (Boyer & Liénard, 2006). Once ‘captured’ we are motivated to make sense of the ‘why’ and ‘how’ by applying intuitive causal or social heuristics, or by appealing to supernatural influence or causation (J. Barrett & Lawson, 2001; Lawson & McCauley, 1990; Legare & Souza, 2012; Schjødt & Sørensen, 2013; Sørensen et al., 2006). In two studies of similar design, J. Barrett and Lawson (2001) and Sørensen et al. (2006) investigated which characteristics of ritual contribute to perceptions of ritual effectiveness. In both studies participants were presented with a series of vignettes in which elements of a ritual were manipulated.

J. Barrett and Lawson (2001) provided a ‘prototype’ statement to participants (e.g., ‘A special person blew ordinary dust on a field and the field yielded good crops’) with aspects of that prototype varied in order to determine the contribution of the special status of objects, the nature of objects and individuals, and the described action (e.g., ‘An ordinary person blew special dust on a field...’, and ‘A special person kicked ordinary dust on a field...’). Participants then responded to the question ‘How likely is each of the following actions to find favor with the gods and yield good crops?’.

Similarly, Sørensen et al. (2006) provided a prototype statement (e.g., ‘In order to settle

the division of land among the Uu'lofa the medicine-man strikes the ground emphatically three times with the sacrificial axe'), and provided varied iterations ('The medicine-man strikes the ground emphatically once with the sacrificial axe' and 'The medicine-man strikes the ground emphatically three times with an axe'). Participants were then asked 'How likely is it that the Uu'lofa believe each of the following acts will settle the division of land?'

J. Barrett and Lawson (2001) were particularly interested in how markers of specialness (i.e., 'S-markers') influenced ratings of effectiveness, where participants were told that 'specialness' was '...something that has been given special properties or authority by the gods'. They predicted that participants would rely on an understanding of 'social action' to infer the act's efficacy. In support of this claim, where elements of ritual were described as 'special', participants' ratings of efficacy increased especially when the agent was 'special', and when the larger sequence of actions involved more than one 'special' element (i.e., when a special agent acted on a special object). However, participants still rated rituals without S-markers as likely to be effective, albeit at significantly lower rates. Sørensen et al. (2006) found that when they changed the agent of a ritual (from a Medicine-man to Farmer, for example) it had a greater influence on ratings of effectiveness than similar changes to the instrument (from an axe to a hoe) or the action performed (from strike to drop); yet they found mixed and conflicting results regarding the S-marker's contribution to efficacy ratings. That is, removing an S-marker did not reliably diminish ratings of efficacy in all analyses (particularly for instruments). Their strongest finding relates to the contribution a special agent made to the ritual. Sørensen et al. (2006) and J. Barrett and Lawson (2001) argue that ritual acts are 'special' in a way profane acts are not, that the agent occupies a privileged position in the ritual, and rituals are performed in the service of, or as appeals to, supernatural agents. And yet we must consider the following in interpreting their conclusions: The work of Sorensen and colleagues removed the participant from the context of the ritual when they were providing their responses. They asked "*Rate how likely it is that **the Uu'lofa** believe each of the*

following acts will have the desired effect?” [emphasis added]. This is a question, not about whether a participant believes a ritual act is efficacious, or the mechanism is veridical, but whether or not the participant believes the Uu’lofa believe the act will cause an effect. This does not directly speak to the participant’s perceptions of ritual efficacy. For example, a non-Catholic may recognize that Catholics believe communion appeases their god, and that Catholics recognize the act as legitimate, but a non-Catholic can easily eschew sharing such convictions, and not be persuaded that the ritual is more (or less) effective if various elements of the ritual were changed. Such variations would influence the responses of a Catholic, just as variations would influence the hypothetical Uu’lofa people. Participants, in this experiment, are making a second-order attribution. They are making a claim about the beliefs of others.

J. Barrett and Lawson (2001) conclusions are not without their own problems, either. In the key manipulation in both experiments, participants were provided with the statement that ‘special’ is “... *someone or something that has been given special property or authority by the gods*” and found that when they used the term special people agreed a supernatural outcome was likely. A rich interpretation of the data suggests that participants believe special agents (or action, or instruments) can bring about supernatural outcomes (for a given definition of special); but a leaner accounts suggests that participants understood that the experimenters wanted them to understand that ‘special’ = ‘supernatural’ and then logically applied the premise throughout. For example, J. K. Rowling, in her obscenely successful Harry Potter series, has set the premise that magic exists, the spell ‘Patronus’ exists, and ‘Dementors’ exist. Further, the spell Patronus, via magical mechanisms, repels Dementors and protects the caster from their sinister influence. If you were to ask a Harry Potter fan ‘Does casting the magic spell ‘Patronus’ scare away Dementors?’ the only reasonably answer they can provide is ‘Yes’. This reveals they understood the premise and they followed the premise to its logical conclusions. No actual belief about supernatural influence is required to logically simulate this sequence of events and affirm the expectation that ‘magic works’ (or, in the case of Barrett and Lawson, that

‘supernatural authority begets supernatural outcomes’).

Furthermore, in Experiment 1, Barrett and Lawson (2001) ask participants: “*How likely is each of the following actions to find favor with the gods and yield good crops?*”. This is problematic, as the question is double-barreled, and a score of ‘very likely’ may be with reference to the god’s favor, the good crops, or both. Given that ‘special’ was explicitly defined prior to the experiment (in all cases) we can have no empirical faith that a ‘very likely’ response is anything but a participant responding to instructions within the framework provided.

The data provided in both of the afore-discussed studies do not satisfactorily address how and why typical participants (with typical cognitive resources) interpret ritual actions. Thus, it may not simply be that participants apply causal and social heuristics to rituals under the assumption that they are for the gods (as with the social-action hypothesis), but that they can simply follow instructions and willfully suspend disbelief. In both instances participants are responding to the expectations of the experimenters and following the logic laid out in the experiment.

Recently, Legare and Souza (2012) examined the extent to which participants infer ritual efficacy based on intuitive causal principles and heuristics, and in so doing, avoided the second-order attribution problem, as well as avoiding problematic methodologies. They appropriated a ritual practice native to Brazil (known as a ‘Simpatia’) and obscured its apparent purpose to participants. An example of a Simpatia, one used to prevent a partner’s infidelity, involves throwing a white handkerchief into a running river. First, they established that Brazilian participants did not reliably (or accurately) pair a given Simpatia with its original purpose at rates above chance (which avoid criticisms that participants are simply logically applying a provided definition within a set context). They report that particular elements of the act contributed to ratings of ritual efficacy. Of 9 ritual elements, 3 were found to significantly improve efficacy ratings if they were situated within a larger sequence of ritual actions. These elements were specificity in time (e.g., first day of a last quarter moon), greater repetition of procedures, and greater number of steps. This was true of

a sample of Brazilians who actively use and endorse *Simpatias* in their daily lives, as well as a group with no such convictions (the former group also reported greater efficacy if the ritual included a religious icon, while the latter did not). Similarly, American undergraduates (at a South-West university) were influenced by the same ritual elements: repetition, number of steps, and presence of religious iconography (unlike Brazilians, however, they did not rate specificity in time as a significant contributor). Strangely, no groups perceived that common elements like specificity of place, material, or the number of items, contributed to the efficacy of rituals. Importantly, participants were not asked whether they thought an adherent to *simpatia*-magic would consider it effective, but rather ‘the extent to which they thought the *simpatia* would be effective for treating the specific problem’. This avoids the second-order attribution problem (as with Sorensen et al. (2006), and allowed the participant to reason about the ritual without having been primed in the manner of Barrett and Lawson (2001); they also avoided double-barreled questions). Their results suggest that, to the extent that it is impossible [for the participant] to directly infer the causal relationship of a ritual (how exactly does a thrown handkerchief reduce infidelity?), observers rely on a set of ordinary and intuitive causal heuristics – doing something at the specific time is better than at any time, doing something many times is better than doing something once, and sophisticated procedures are better than simple ones. More importantly, these are the participants’ own responses; it is easy to imagine that Americans naïve to *simpatias* would rate ‘specificity of place’ (a feature not found to contribute to efficacy for either group) highly if they were asked whether they thought a Brazilian believed it was important for the ritual, or whether a foreign supernatural agent required it.

In the current set of experiments we build upon this literature in a number of ways. First, we address issues of methodology and stimuli. Previous research has employed written vignettes, which, while versatile, leave much to the participant’s imagination. For participants to consider a *Uu’lofa* medicine-man is to permit them to imagine him consistent with their own stereotypes, prejudices, and imagery (perhaps adorned with feathers, face-paint, or after having eaten psychedelics). In contrast we

use video stimuli in order to minimize the influence of a participants' idiosyncratic imagination. Second, we emphasize the role of causal opacity, which up to this point has been generally overlooked. Rituals are perceived as more effective when specific conditions are met, but why these conditions and not others? We predict such conditions are made salient by virtue of their opacity. A special medicine-man has the authority of the gods, and a special act courts divine favor, but how? Doing something many times is better than once, and complicated acts are superior to simple ones, but why? The relationship between act and the intended outcome is opaque, and this is a key element of our research. Third, we omit reference to the supernatural. We believe that much of the research presented earlier can be interpreted in light of ordinary social factors (consistent with the ritual stance) without needing to consider another group's supernatural social-causal beliefs (which we address, in part, by reconciling the second-order attribution problem).

We are mindful, in the current study, of this attribution problem, and in reference to the stimuli, we ask participants to report their own thoughts, and predict their own behaviour. We also directly manipulate the degree to which a ritual belongs to an identifiable group with specific beliefs. Naturally, each of our rituals is in accordance with the definition provided: They are causally opaque, include formality, repetition, redundancy, stereotypy, focus on process, and are presented inflexibly. But rather than pairing ritual stimuli with similarly opaque actions (as previous cited studies have done) we pair them with matched control actions which are causally transparent (they are instrumental, less formal, and are presented relatively flexibly). We further enhance the opacity of the act by denying participants any knowledge of the ritual's purpose (what is the ritual supposed to achieve?) or the authority by which the act is performed (who or what specified the actions in question?). In fact, we omit any reference to supernatural authority. Moreover, we use the word 'special' in an undefined way, rather than imbuing the word with supernatural significance. Using the word special may prime participants to think about the actions in a particular way, but since we use it equally across all conditions we do not believe it confounds our design. Importantly, the

word ‘special’ alone, by any typical definition or use of the word, does not include reference to the supernatural. By using the term in this manner, we deny participants knowledge (or inference) that the actions are performed by, or for, a supernatural agent (as with past research).

The ritual stance, upon which this research is based, broadly predicts that when we naively observe a causally opaque ritual act (that is, when we cannot easily infer the instrumental purpose, causal mechanism, or even the performer’s underlying motivation) we interpret it as socially normative and informative, and subsequently consider that it may require a change in beliefs or behaviour (Herrmann et al., 2013; Legare & Souza, 2012; Legare, Whitehouse, et al., 2015; Nielsen, Kapitány, & Elkins, 2014; Vohs et al., 2013). This is similar and generally consistent with other authors who propose that rituals arrest our attention and executive functions, and create an attributional and inferential gap which we are motivated to fill with meaning, interpretation or behaviour (Csibra & Gergely, 2011; Rossano, 2012; Schjødt & Sørensen, 2013). This is in contrast to proponents of the social-action hypothesis (J. Barrett & Lawson, 2001; Lawson & McCauley, 1990), who predict that we understand a ritual with reference to its ‘special’ (supernatural) qualities.

We employed a 2x2 between-participants design in which participants were randomly assigned to one of four conditions: 1) Ritual with no context, 2) Ritual with context, 3) Control actions with no context, or 4) Control actions with context. As there is no ‘knowable’ physical-causal relationship between the actions performed and any perceivable outcomes, we did not anticipate any difference across conditions in participants’ attribution of physical change to the objects. Conversely, consistent with the ritual stance (Herrmann et al., 2013; Legare & Souza, 2012; Nielsen, Kapitány, & Elkins, 2014), we hypothesized that participants who observe opaque (ritualistic) actions (i.e., those in conditions 1 and 2) will be more likely to attribute a change in the object’s ‘specialness’ (here left undefined in order to solicit natural responses) than those who observe transparent (ordinary) actions (conditions 3 and 4). We similarly hypothesized that participants observing opaque actions will be more likely to

desire/prefer ritualized objects compared to participants in control conditions. These effects will be moderated by the presence of context, such that participants in conditions 2 and 4, who are told the actions belong to an established ritual, will continue to infer no physical change, but will more frequently attribute status change and more frequently find the acted-upon object desirable.

Experiment 1

Methods.

Participants. One hundred and one undergraduates of a large metropolitan university (77 female, 23 male, and 1 unreported) participated in this study in exchange for course-credit. The age of participants ranged from 17 – 37 years ($M = 19.76$, $SD = 3.20$), and 88% reported English as their native language (details of native language was not collected of those for whom English was a second language). An additional 373 adults (176 female, 197 male, and 1 unreported) were recruited on Amazon's Mechanical Turk (mTurk) in exchange for US\$1.70. These participants ranged in age from 18 – 72 years ($M = 35.33$, $SD = 11.35$), 99.5% reported English as their native language, and 99.5% reported living in the US (.5% values unreported). A total of 39% reported completing a tertiary degree and a further 11% reported holding a Post-graduate degree, while 31.6% reported 'some tertiary'. Of the remaining participants, 17.6% completed high school while only .3% reporting 'some high school'; there were 2 missing values (0.5%). 42.2% of participants earned less than \$25,000(US) a year, 16.7% earned between \$25,001 and \$35,000, and 14.5% earned between \$45,001 and \$55,000 (all of whom accounted for 86.8% of the sample), the remaining 13.2% reported earning in excess of \$55,001 annually.

Procedure. All participants were briefed on the task and completed basic demographic details before being randomly assigned to one of four conditions in which they were shown a total of 6 videos (two videos per each block of stimuli; video and block order fully randomized). After viewing each video participants were asked to respond to a number of quantitative and qualitative questions. Qualitative questions

were collected in order to help illuminate any confusing participant responses or attributions. They included “*Which drink is special, and why?*” and “*Why did you select that drink [to drink]?*”. A brief and informal survey of these data was undertaken, but it was concluded that they provided no information above-and-beyond the quantitative data, and hence these were not included in any later analyses. Participants then completed a number of surveys including ‘The Revised Paranormal Beliefs Scale’ (26-items; Tobacyk, ‘The Rational-Experiential Inventory’ (40-items; Pacini and Epstein), a ‘Religiosity Scale’ (8-items; Rohrbaugh and Jessor), and a novel scale assessing the participant’s ‘History of religious and ritual exposure’ (16-items; See Appendix A). The novel scale was created in order to determine active involvement in both everyday and religious rituals, as well as participants’ expectations that involvement in such rituals was normative.

Materials. Three novel rituals were created which contained a series of causally, instrumentally and motivationally opaque motor actions. Three matched action sequences were developed as controls, in which the actions were causally, instrumentally and motivationally transparent. All videos involved the pouring of a drink (from a small glass) into a (larger) glass. Examples of videos are available at [website redacted to maintain anonymity; see attachment for examples of stimuli], and all videos are available from the first author upon request.

Videos were integrated into three discreet stimuli blocks. Block 1 involved one action (ritual or control) performed on one of two glasses, Block 2 involved one action performed on one of three glasses, and Block 3 involved two actions performed on two of three glasses. While we predict that the efficacy of a ritual may be due to its opacity, it may also be due to the fact that rituals tend to single out specific items. In Blocks 1 and 2, one glass is singled out by virtue of the act performed upon it (thus making salient its ‘singleness’). In Block 3, however, two of three glasses are acted upon, which singles out the third glass (which was not acted upon). Thus, this third block was included to determine whether ritual acts, rather than singling acts, imbue objects with special qualities. In order to fully counter-balance the location of the acted-upon object

across each block a total of 24 ritual and 24 control videos were created in which all possible iterations of action and glass-position (left, right, and center) were recorded for each Block. A total of 12 videos were created for the Block 1 presentations (six per condition); 18 videos were created for the Block 2 presentations (nine per condition); and a further 18 videos were created for the Block 3 presentations (nine per condition).

Both the ritual and control videos follow identical formats (see Figure 1). In each video all materials were presented on a table at the beginning of the sequence. The demonstrator moved each of the [larger] glasses toward the front of the table, and then performed an action (varied according to condition). A golden-yellow liquid was then poured from the smaller glass into the larger glass, from right to left. In the ritual condition the smaller glass was raised vertically prior to pouring, whereas the control condition omitted this redundant, opaque action. Finally, the glasses subjected to the action sequence were then raised and either bowed to (ritual condition) or inspected (as if viewing the level of the liquid; control condition). Glasses were returned to their forward position and the demonstrator returned to a neutral posture. Three ritual actions were created and matched with three control actions.

For two conditions the actions were paired with a brief statement about the context of the act, which followed the form: ‘This video contains elements of established ritual seen around the world. The actions in this video can be seen in [ceremony name] of [Location]’. The ceremonies used were: ‘Bwiti Ceremony (Gabon, Africa)’, ‘Kava Ceremony (Fiji, Pacific Islands)’, and ‘Ayahuasca Ceremony (Ecuador, South America)’. Participants were randomly assigned to one of the following four conditions: Condition 1 – Ritual action with context; Condition 2 – Ritual action without context; Condition 3 – Control action with context; and Condition 4 – Control action without context. All participants were provided brief written instructions asking them to ‘watch the following video in full before moving on to the next page’ (videos were set to a timer so that participants couldn’t move on until a length of time slightly greater than the duration of the video had passed). For our stimuli, we selected motor actions that were flexible enough to be applied opaquely (in a ritual context) and transparently (in a

control context), and which were not already laden with cultural meaning - for example, lighting candles may imply mourning or celebration; waving a cloth, on the other hand, holds fewer cultural assumptions, given the context. The transparent actions needed to afford viewers an easy instrumental interpretation, and so we chose actions that were simple, familiar, and relatable (involving cleaning or inspection).

The 'Cloth' and 'Gesture' control actions are cleaning actions, while the 'Hum' control gesture was a familiar utterance that conveys an identifiable motive (inspection, noting something of interest, or identifying an interesting quality of the referent). The opaque/ritual actions were neither familiar nor identifiable, nor did they afford participants a simple physical interpretation; furthermore, these actions were obviously causally redundant. In all instances, the opaque ritual actions had start-end-state equivalency. That is, the objects in this condition were not discernibly (nor actually) different after the actions than they were before them (Watson-Jones et al., 2014). The actions in the transparent/control condition, however, conceivably made (or revealed) changes in the object. In the 'Cloth' and 'Gesture' actions, the object has been physically interacted with (it's been cleaned), which affords a valid interpretation of a [possible] real, physical change; the 'Hum', while making no physical change to the object, implies the actor has observed a veridical difference in this object; the 'Hum' cues an interpretation of a revealed difference. Thus, transparent/control actions violate start-end-state equivalency, and allow for the valid interpretation that the actions make or reveal a physical difference in the object (even if making such a distinction is not immediately possible), while the opaque/ritual actions comply with start-end-state equivalency, and do not allow for any reasonable or valid interpretation that the actions caused physical outcomes.

The nature and content of the rituals and control actions were as follows:

Gesture Action. In the ritual condition the demonstrator closed his hand and pointed with two fingers at the glass, while making two circular motions around the opening of the glass (the diameter of the gesture was approximately twice the diameter of the opening); at no point did the gesture make contact with the glass. The matched control action had the demonstrator – using the same hand position – ‘dust’ the glass with his fingers as if removing grit.

Hum action. In the ritual condition the demonstrator held the glass at head-height and began to hum in a long, unwavering and sustained fashion (of the nature ‘*mmmmmm...*’; duration approximately three seconds). In the control condition the demonstrator held the glass similarly and made a shorter, more variable noise, of the nature ‘*hmm...*’ (as if inspecting or observing a curious aspect of the object). No physical or causal relationship between object and action was discernible in either condition.

Common to all actions. All ritual actions included two further elements. In both the control and ritual conditions, glasses that were not subject to a ritual (but which may have been subject to a control action) were filled by lifting a smaller glass and pouring directly and efficiently into the larger glass. When an object was subject to a ritual action (but not a matched control action) the smaller glass was lifted as if it were about to be poured into the larger glass, but was then swiftly raised vertically before being lowered and poured in the glass. Furthermore, after the completion of the pouring, the target glass(es) (in both conditions) was (were) acted upon once more. In the ritual condition the ritual glass(es) was (were) raised with both hands and bowed to in a reverential fashion. In the control condition the glass(es) were raised with one hand and inspected with a head-cocking motion in an irreverent (if curious) fashion.

Measures and Coding. We had three primary dependent variables. We first asked whether participants thought the drinks were the same/identical, whether any of the drinks were ‘special’, and which drink they would prefer to drink. In the first instance, to gauge if participants inferred whether a physical-causal process had occurred, we asked whether the drinks were the same/identical. This was of primary

interest in the Ritual condition – if opaque actions had start-end-state equivalency, then there ought not be any observable difference. In the second instance, we measured whether participants perceived ‘specialness’ among the object set. On the prediction that no physical differences would be observed, we needed to determine whether participants made any attribution regarding the objects, then, whether or not the attribution was specific to ritual actions or simply to objects which were singled out. We deliberately left the term ‘special’ undefined in order to get at whether participants perceived (perhaps idiosyncratically) a change in the object’s status (and not exclusively in relation to supernatural power, as Barrett and Lawson (2001) and Sorensen et al (2006) have previously used the term). And in the final instance, the ritual stance predicts a normative interpretation of ritual actions, which, based on previous research begets a behavioural response (Herrmann et al., 2013; Legare & Souza, 2012; Legare, Wen, et al., 2015; Nielsen, Kapitány, & Elkins, 2014; Watson-Jones et al., 2014).

All participants watched a total of six videos (two videos from each of the three blocks). After each video participants were asked a series of questions. When asked ‘Are the drinks the same?’ (or ‘are the three drinks the same’ in blocks 2 and 3) participants could report that they were the same/identical (coded = 1), or that they were not the same/not-identical (coded = 0). When asked ‘is either drink special?’ (or ‘are any of the three drinks special’ in blocks 2 and 3) participants could report either ‘Yes’ (coded = 1), or ‘No’ (coded = 0). When asked ‘which drink would you select to drink?’ participants could indicate their selection by clicking ‘I would drink the [location] drink’ (where ‘left’, ‘center’, or ‘right’ was specified). Their responses were dummy coded by location, and later converted into values that represented whether they selected a drink that was acted upon (coded = 1) or a drink that was not acted upon (coded = 0). Scores were summed for all variables; given that participants saw only 2 videos per block, a maximum score of 2 was possible (per block) for each stimuli type on each of the above three measures.

Data Analysis. We treated the coded product of our experiment as ordered categorical data. The appropriate analytic tool for such data is an Ordinal Logistic

Regression (OLR). Where assumptions of OLR are violated, we use Multinomial Logistic Regression (MLR). Much like a Binary Logistic Regression, an OLR returns a Wald value to determine significance, and is interpreted by way of an Odds Ratio. An Odds Ratio represents the likelihood of belonging to one of the categorical DVs given the value of an IV. Specific to OLR, the odds ratio applies consistently for each level of the DV.

An important assumption of an OLR is that of proportional odds. When this assumption is violated it is appropriate to run a MLR, which treats the relationships between the categories as arbitrary. For further information on OLR and MLR please see: Field (2013); Kleinbaum and Klein (2010); Menard (2010).

Results

There were no differences between the undergraduate participants and those recruited via mTurk on any of the dependent variables. Subsequent analyses of these variables were therefore conducted on a single dataset, collapsed across populations ($N = 475$).

Did participants perceive drinks as ‘the same’? Data on the ‘same’ variable was coded such that one point was assigned to a response in which the participant indicated that the glasses were different. Thus, across two trials, if a participant said that the glasses are different on both trials, they had a total score of 2 (corresponding to category 2 – ‘Glasses the same on both trials’). All ‘same’ analysis returned a null result on the Test of Parallel Lines ($p > .05$) and satisfied the assumption of proportional odds, indicating OLR was an appropriate statistical tool. Results are presented in Table 1.

Across Blocks 1 and 2 (two glasses one action, and three glasses one action, respectively) we found that our OLR did not provide a better fit than the general model. In Block 1 the final model fit was not significant, $\chi^2(2) = 3.735$, $p = .155$, nor was the model fit in Block 2 $\chi^2(2) = 2.922$, $p = .232$. In both cases this indicates that a model with predictors is not better than a general model without predictors.

In Block 3 (three glasses two actions) we found a significantly better final model fit, $\chi^2(2) = 6.577$, $p = .037$, indicating that a model with predictors was better than a model without predictors. Pearson's Goodness-of-fit, $\chi^2(4) = 9.509$, $p = .05$, did not fall below the threshold ($p < .05$). As Table 1 shows, the presence of opacity makes it 1.595 times more likely that participants will report that there is a difference between glasses at each level of the DV. Pseudo- R^2 values range from .011 (McFadden) to .014 (Nagelkerke). Figure 2 shows the proportion of responses in each category across all four conditions.

Table 1

Parameter estimates of ordinal logistic regression for 'same' scores for all three blocks of stimuli

Predictor	Log Odds	SE	Wald's χ^2	p	95%CI	Odds Ratio
<i>Block 1: Two Glasses One Action</i>						
Opacity (1) vs Transparency (0)	-0.49	0.263	3.456	0.063	-0.026 - 1.006	-
Context (1) vs No Context (0)	-0.134	0.261	0.265	0.606	-0.377 - 0.645	-
<i>Block 2: Three Glasses One Action</i>						
Opacity (1) vs Transparency (0)	-0.195	0.224	0.758	0.384	-0.244 - 0.635	-
Context (1) vs No Context (0)	-0.337	0.226	2.237	0.135	-0.105 - 0.780	-
<i>Block 3: Three Glasses Two Actions</i>						
Opacity (1) vs Transparency (0)	-0.467	0.229	4.165	0.041	0.019 - 0.916	1.595
Context (1) vs No Context (0)	-0.361	0.229	2.483	0.115	-0.088 - 0.809	-

Did participants perceive 'specialness' among the drinks? Data on the 'special' variable was coded such that one point was assigned to a response in which the participant indicated that a special glass was present. Thus, across two trials, if a participant said that a special glass was present on both trials, they had a total score of 2 (corresponding to category 2 – 'special glasses were present on both trials'). All 'special' analysis returned a null result on the Test of Parallel Lines ($p > .05$) and satisfied the assumption of proportional odds, indicating OLR was an appropriate

statistical tool. Results are presented in table 2.

In Block 1 (two glasses one action) we found a significantly better final model fit, $\chi^2(2) = 27.525$, $p < .001$, indicating that a model with predictors was better than a model without predictors. Pearson's Goodness-of-fit, $\chi^2(4) = 8.368$, $p = .079$, did not fall below the threshold ($p < .05$). As Table 2 shows, when actions are opaque, participants are 1.76 times more likely to report the presence of specialness at each [increasing] level of the DV. Likewise, when context is present, participants are 2.30 times more likely to report the presence of specialness at each [increasing] level of the DV. Pseudo- R^2 values range from .035 (McFadden) to .073 (Nagelkerke).

In Block 2 (three glasses one action) we found a significantly better final model fit, $\chi^2(2) = 32.524$, $p < .001$, indicating that a model with predictors was better than a model without predictors. Pearson's Goodness-of-fit, $\chi^2(4) = 8.006$, $p = .091$, did not fall below the threshold ($p < .05$). As Table 2 shows, when actions are opaque, participants are 2.65 times more likely to report the presence of specialness at each [increasing] level of the DV. Likewise, when context is present, participants are 1.46 times more likely to report the presence of specialness at each [increasing] level of the DV. Pseudo- R^2 values range from .036 (McFadden) to .078 (Nagelkerke).

In Block 3 (three glasses two actions) we found a significantly better final model fit, $\chi^2(2) = 39.556$, $p < .001$, indicating that a model with predictors was better than a model without predictors. Pearson's Goodness-of-fit, $\chi^2(4) = 8.131$, $p = .087$, did not fall below the threshold ($p < .05$). As Table 2 shows, when actions are opaque, participants are 2.73 times more likely to report the presence of specialness at each [increasing] level of the DV. Likewise, when context is present, participants are 1.76 times more likely to report the presence of specialness at each [increasing] level of the DV. Pseudo- R^2 values range from .036 (McFadden) to .078 (Nagelkerke). Figure 3 shows the proportion of responses in each category across all four conditions.

Which drink did participants select to drink? Data on the 'drink' variable was coded such that one point was assigned to a response in which the participant indicated that they would drink the acted upon drink. Thus, across two trials, if a

Table 2

Parameter estimates of ordinal logistic regression for ‘special’ scores for all three blocks of stimuli

Predictor	Log Odds	SE	Wald’s χ^2	<i>p</i>	95%CI	Odds Ratio
<i>Block 1: Two Glasses One Action</i>						
Opacity (1) vs Transparency (0)	-0.565	0.191	8.702	0.003	0.189 - 0.940	1.759
Context (1) vs No Context (0)	-0.834	0.191	19.014	< .001	0.459 - 1.209	2.303
<i>Block 2: Three Glasses One Action</i>						
Opacity (1) vs Transparency (0)	-0.975	0.182	28.542	< .001	0.617 - 1.332	2.651
Context (1) vs No Context (0)	-0.376	0.182	4.279	0.039	0.020 - 0.733	1.456
<i>Block 3: Three Glasses Two Actions</i>						
Opacity (1) vs Transparency (0)	-1.006	0.185	29.570	< .001	0.643 - 1.396	2.735
Context (1) vs No Context (0)	-0.566	0.184	9.437	0.002	0.205 - 0.928	1.761

participant said that they would drink the acted upon drink on both trials, they had a total score of 2 corresponding to category 2 – ‘chose acted-upon objects exclusively’). All ‘drink’ analysis returned a significant result on the Test of Parallel Lines ($p < .05$), indicating that the logit (the odds ratio) varies between levels of the DV for a given significant IV. As a result, we used MLR analysis, which ignores the ordered nature of the data and treats it as nominal (arbitrarily ordered). Results are presented in table 3.

In Block 1 (two glasses one action) we found a significantly better final model fit, $\chi^2(4) = 31.085$, $p < .001$, indicating that a model with predictors was better than a model without predictors. Pearson’s Goodness-of-fit, $\chi^2(2) = .317$, $p = .854$, did not fall below the threshold ($p < .05$). As Table 3 shows, when actions are opaque, participants are 2.84 times more likely to report preferring to drink the acted upon object only at level 2 of the DV. Likewise, when context is present, participants are 2.00 times more likely to report preferring to drink the acted upon object only at level 2 of the DV. Pseudo- R^2 values range from .030 (McFadden) to .072 (Nagelkerke). Neither Action Type nor Context significantly predicted responses at Level 1 of the DV.

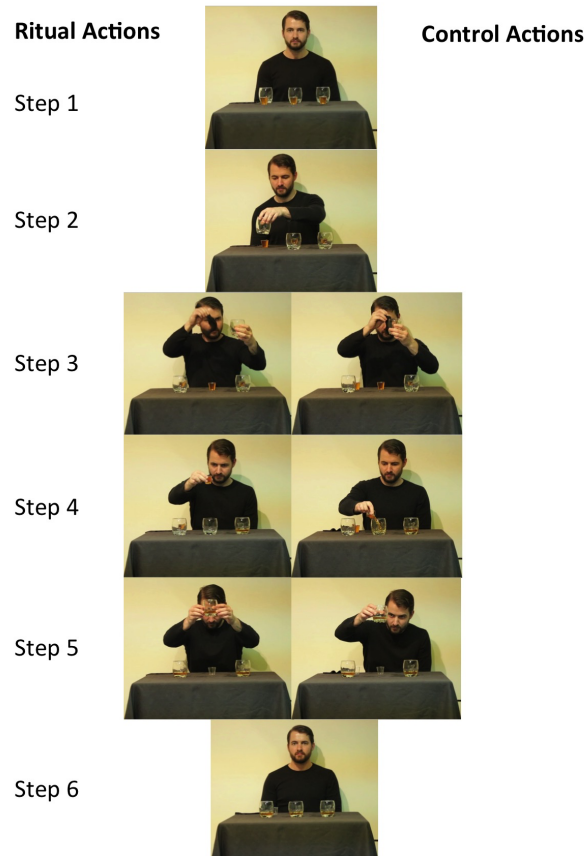
In Block 2 (three glasses one action) we found a significantly better final model fit, $\chi^2(4) = 43.296$, $p < .001$, indicating that a model with predictors was better than a model without predictors. Pearson's Goodness-of-fit, $\chi^2(2) = .085$, $p = .958$, did not fall below the threshold ($p < .05$). As Table 3 shows, when actions are opaque, participants are 3.60 times more likely to report preferring to drink the acted upon object only at level 2 of the DV. Likewise, when context is present, participants are 1.76 times more likely to report preferring to drink the acted upon object only at level 2 of the DV. Pseudo- R^2 values range from .043 (McFadden) to .099 (Nagelkerke). Neither Action Type nor Context significantly predicted responses at Level 1 of the DV.

In Block 3 (three glasses two actions) we found a significantly better final model fit, $\chi^2(4) = 13.611$, $p = .009$, indicating that a model with predictors was better than a model without predictors. Pearson's Goodness-of-fit, $\chi^2(2) = .652$, $p = .722$, did not fall below the threshold ($p < .05$). As Table 3 shows, when actions are opaque, participants are .56 times as likely to report preferring to drink the acted upon object only at level 1 of the DV. Separately, when context is present, participants are 1.68 times more likely to report preferring to drink the acted upon object only at level 2 of the DV. No other significant effects were observed. Pseudo- R^2 values range from .013 (McFadden) to .032 (Nagelkerke).

Figure 4 shows the proportion of responses in each category across all four conditions.

Survey results. Undergraduates ($M = 2.61$, $SD = 1.23$) scored significantly higher on the Religiosity scale than mTurk participants ($M = 2.28$, $SD = 1.28$), $t(474) = 2.318$, $p = .021$; Similarly, on the novel scale of Ritual and Religious exposure, undergraduates ($M = 3.24$, $SD = .65$) had more exposure and involvement in ritual than mTurk participants ($M = 2.99$, $SD = .72$), $F(1,473) = 10.294$, $p = .001$ (See Table 4 for separate and combined means and standard deviations on survey items). Regardless, there were no consistent patterns of association between survey items and dependent variables for the populations combined (Table 5; correlations for each population separately can be found in Tables B1 and B2 of Appendix B).

Figure 1. Matching ritual and control actions



The 6 illustrated steps demonstrate the similarities between the ritual and control actions (images show the ‘Cloth’ ritual acted upon the center glass). For both the ritual and control conditions steps 1 and 2 are identical, wherein the action begins and the demonstrator moves the smaller glasses in front of the larger glasses. In ritual Step 3 the cloth is waved vigorously at the glass, while in the control condition the cloth is used to clean the glass. In ritual step 4 the smaller glass is raised high before being poured into the larger glass, whereas in the control condition the smaller glass is poured directly. In ritual step 5 the glass is raised with both hands and bowed to, whereas in the control condition it is raised with one hand and inspected. Step 6 (for both conditions) shows the demonstrator returning to a neutral position.

Figure 2. Responses as a percentage of total responses on ‘same’ variable across all blocks.

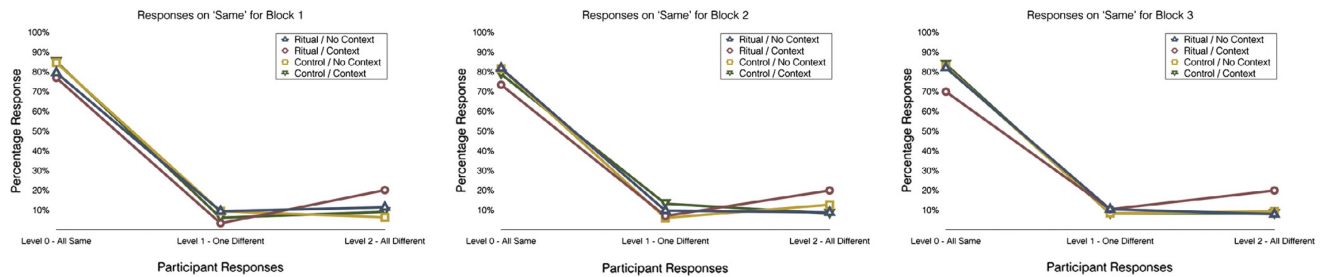


Figure 3. Responses as a percentage of total responses on ‘special’ variable across all blocks.

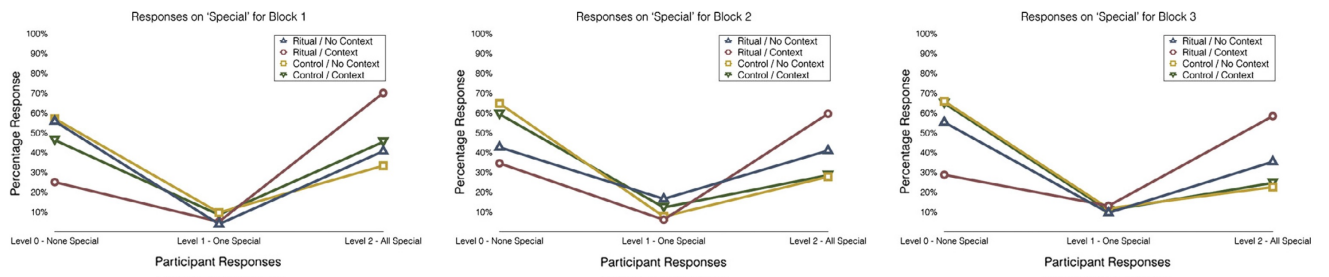


Figure 4. Responses as a percentage of total responses on ‘drink preference’ variable across all blocks.

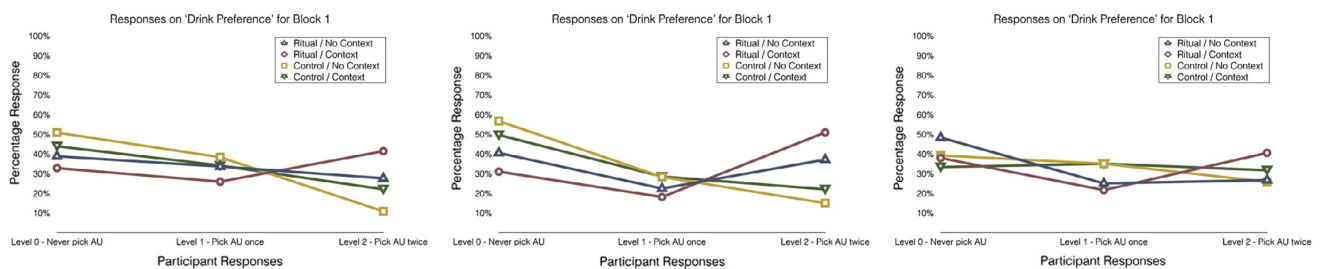


Table 3

Parameter estimates of multinomial logistic regression for 'drink' scores for all three blocks of stimuli

Predictor	Log Odds	SE	Wald's χ^2	<i>p</i>	95%CI	Odds Ratio
<i>Block 1: Two Glasses One Action</i>						
<i>Pick acted-upon object once</i>						
Opacity (0) vs Transparency (1)	0.082	0.216	8.99	0.144	0.711 - 1.658	-
Context (0) vs No Context (1)	-0.021	0.215	0.010	0.921	0.643 - 1.491	-
<i>Pick acted-upon object twice</i>						
Opacity (0) vs Transparency (1)	1.045	0.244	18.36	< .001	1.763 - 4.585	2.843
Context (0) vs No Context (1)	0.691	0.242	8.179	0.004	1.243 - 3.204	1.996
<i>Block 2: Three Glasses One Action</i>						
<i>Pick acted-upon object once</i>						
Opacity (0) vs Transparency (1)	0.061	0.236	0.067	0.796	0.669 - 1.668	-
Context (0) vs No Context (1)	0.104	0.232	0.200	0.655	0.704 - 1.746	-
<i>Pick acted-upon object twice</i>						
Opacity (0) vs Transparency (1)	1.282	0.230	31.141	< .001	2.297 - 5.651	3.604
Context (0) vs No Context (1)	0.563	0.225	6.251	0.012	1.129 - 2.730	1.756
<i>Block 3: Three Glasses Two Actions</i>						
<i>Pick acted-upon object once</i>						
Opacity (0) vs Transparency (1)	-0.580	0.227	6.515	0.011	0.658 - 0.874	0.560
Context (0) vs No Context (1)	0.144	0.226	0.408	0.523	0.742 - 1.798	-
<i>Pick acted-upon object twice</i>						
Opacity (0) vs Transparency (1)	-0.015	0.221	.005	.945	0.638 - 1.520	-
Context (0) vs No Context (1)	0.519	0.222	5.475	0.019	1.088 - 2.596	1.680

Note: The dummy coding of the IV's has been reverse from previous OLR analysis. this has been done so that, as IV levels increase, a positive Log Odds Coefficient reveals an increase in the likelihood for DV categories. This makes the results more easily interpreted, and is due to the underlying mathematical structure of MLR compared to OLR using SPSS. The reference category for the DV (0) is 'Did not pick any acted upon objects'.

Table 4

Survey results for both undergraduates and mTurk samples (including collapsed totals; Study1)

Scale	Undergraduate mean (SD)	mTurk mean (SD)	Combined mean (SD)
Revised Paranormal Beliefs Scale	2.82 (0.93)	2.77 (0.93)	2.78 (1.16)
7-point			
Rational Subscale	3.52 (0.49)	3.63 (0.71)	3.61 (0.67)
5-point			
Intuitive Subscale	3.28 (0.53)	3.19 (0.80)	3.21 (0.75)
5-point			
Religiosity Scale	2.61 (1.23)*	2.28 (1.28)*	2.35 (1.28)
6-point			
Ritual and Religious Exposure	3.24 (0.65)*	2.99 (0.72)*	3.04 (0.72)
5-point			

$p < .05$

Table 5

Table of correlations between survey items and DV's in Experiment 1 (combined populations: $N = 475$)

Scale	1	2	3	4	5	same			special			drink			
						Block 1	Block 2	Block 3	Block 1	Block 2	Block 3	Block 1	Block 2	Block 3	
1 History of Religious and Ritual Exposure	-	0.384**	-0.066	0.271**	0.531**	0.068	0.038	.039	0.015	-0.022	0.019	-0.026	-0.026	0.065	0.026
2 Paranormal Beliefs	-	-	-0.107*	0.292**	0.503**	-0.018	-0.020	0.005	-0.040	-0.004	-0.001	-0.102*	-0.059	0.028	* $p < .05$; ** p
3 Rational Thinking Style	-	-	-	-0.058	-0.041	-0.040	-0.012	0.027	0.071	0.050	0.043	-0.020	0.045	-0.024	
4 Intuitive Thinking Style	-	-	-	-	0.177**	-0.022	-0.017	0.006	0.003	0.013	-0.006	-0.115*	-0.037	0.047	
5 Religiosity	-	-	-	-	-	0.023	0.046	0.018	-0.051	-0.064	-0.047	-0.030	0.039	-0.045	

< .001. (two-tailed)

Discussion

In Experiment 1 participants were exposed to videos of rituals or matched control tasks, and were either given written context describing the actions or not. The ritual actions were constructed based on common elements of ritual (e.g., redundancy, repetition, formality) with a particular focus on making the actions causally opaque. That is, the ritual actions were designed to have no knowable physical causal relationship with the object, so that it would be impossible for participants to validly infer any physical-causal effects. Our data substantiate these claims, and our hypotheses were supported. In Blocks 1 and 2 (one ritual act performed on one of two, or one of three glasses, respectively) neither action-type nor the presence of context made the models of participants responses more accurate than a general model. Indeed, even in Block 3 where we did find a better fit, it explained less than 1.5% of the variance in the model. In Block 3 (two ritual acts on one of three glasses), we found opacity made it 1.60 times more likely for participants to report that objects differed at each level of the DV, though no effect for context was observed. This finding was unexpected, but is possibly attributable to the fact that one cup was singled out by the demonstrator by virtue of being excluded from specific ritual acts. It may be the case that this cup was made ‘less same’ by virtue of the ritual act, but it’s also possible that participants inferred this cup was excluded as it was different to the other cups prior to the ritual actions. Determining the reason for this finding is beyond the scope of this experiment, but may nevertheless warrant future investigation (assuming this is not a Type I error, given that this effect was not found in Experiment 2).

While ritual acts did not appear to systematically vary physical qualities of the objects studied (and context had no influence whatsoever), this was not the case for intangible qualities. Opaque actions made it considerably more likely that participants would report the presence of ‘specialness’ within the object set, with Odds Ratios (OR) between 1.76 and 2.65; the presence of context had a similar influence (OR between 1.46 and 2.30). On average, opaque actions increased this likelihood more than the presence of context.

In Blocks 1 and 2, participants were more likely to exclusively prefer the acted-upon object if opacity was present (OR between 2.84 and 3.60), but not to occasionally prefer the acted upon object (i.e., chose ‘acted upon’ only once over both trials). Context also appeared to increase likelihood (in Blocks 1 and 2) that participants would exclusively prefer acted-upon objects (OR between 1.68 and 2.00), but not to occasionally prefer the acted-upon object. We did not find this explicit effect in Block 3, though we did notice a decrease in the likelihood that they would occasionally prefer the acted upon object (OR = 0.56). We interpret this as weak evidence that participants’ preference regarding acted-upon and non-acted-upon objects varies as the relationship between action and singleness varies. In Block 3, acting opaquely toward two objects and singling out the third, results in greater preference for non-acted (singled-out) objects, relative to preference in Blocks 1 and 2. That said, the presence of context makes it 1.68 times more likely for participants to exclusively prefer acted-upon objects. Thus, our hypotheses were supported. Ritual actions with causal opacity (with no ‘knowable’ physical-causal relationship) were not more likely to be reported as physically different from objects subjected to transparent actions (indeed, neither action-type appeared to influence physical attributions of the object). However, the presence of opacity lead to ‘special’ object-attributions, which in turn, lead to greater preference for acted upon objects. Providing context, which served a normative cue (i.e., these actions are the actions of a specific group of people) increased the effect. This supports predictions derived from the ritual stance which describe a normative interpretation of ritual actions.

No systematic relationship was observed between survey items and scores on sameness, specialness, or drink preference. This was generally surprising, and while much caution should be exercised in drawing conclusions from null results, it may suggest the literature holds hidden assumptions regarding the role learning and enculturation play in ritual cognition. For example, the literature on ritual is frequently coupled with religion, draws heavily on anthropological studies, and is embedded within a broader literature on the evolution of religion; indeed, many of the rituals we observe

emerging in the wake of social and secular disasters are religiously motivated (Jacobs, 2004). In our study, scores on the Religiosity scale (Rohrbaugh & Jessor, 1975) did not correlate with scores on sameness, specialness, or desirability. Nor did scores on the revised scale of paranormal belief (Tobacyk, 2004), despite having 7 dimensions which cover beliefs relating to Superstition, Spiritualism, Psi, Witchcraft, Religion, Pre-cognition, and Extraordinary life forms. Thinking styles also failed to correlate with the dependent variables; Intuitive thinking has been implicated in superstitious reasoning (Sadler-Smith, 2011) and thinking styles more broadly have been implicated in religiosity and belief (Gervais & Norenzayan, 2012; Shenhav, Rand, & Greene, 2012). Finally, the index of religious and ritual exposure did not correlate with any of the target DVs, despite measuring the degree to which participants had experience with, and normative expectations for, ritual exposure and participation. These null results, though weak from an inferential point of view, suggest that the relationship between ritual and religion may need to be better qualified in the future.

Experiment 2

In Experiment 1 it was shown that context, when paired with ritual actions, can increase perceptions of specialness and preference – presumably by way of the normative social information it provides. Experiment 2 was conducted in order to determine whether the valence of the context influenced the apparent effect. In Experiment 1, the rituals chosen to provide context were relatively novel and neutrally valenced. That is, by using obscure rituals as stimuli participants were unlikely to draw upon prior information (about the groups described) to infer the ritual’s emotional tone – yet still allowed them to validly infer normative, social information. In making this decision we limited the role of context to merely describing the act as belonging to a group and denying participants a meaningful sense of ritual intent. To evaluate the potential impact of prior knowledge, in Experiment 2 the contexts we employed belonged to well recognized groups who are generally regarded as aversive; we described rituals (or control acts) as either satanic, voodooistic, or wiccan (witchcraft). Again, we

denied participants any explicit sense of ritual purpose, but in using these groups we provided participants with inferentially rich information. The religions of Satanism, Voodoo (or Vodou), and Wicca (Modern Witchcraft) are all exceeding minorities in the population sampled (the US) and around the world, but have a history of misrepresentation and malignment in the media and in pop-culture. They are frequently portrayed as threatening, evil, sinister, and being generally in opposition to majority values of the United States. If rituals allow individuals to express identification with groups, and facilitating expressions of commitment to beliefs and values of the groups and its members (Atran & Henrich, 2010; Ensminger, 1997; Henrich, 2009; Konvalinka et al., 2011; Legare & Watson-jones, 2015; Reddish et al., 2014; Ruffle & Sosis, 2007; Sosis & Bressler, 2003; Sosis & Ruffle, 2003; Whitehouse & Lanman, 2014; Wiltermuth & Heath, 2009) then we ought to be relatively calibrated to identifying rituals of groups to which we do not belong, or which we find aversive. Thus, groups such as the ones employed here ought to lead participants to avoid acted-upon objects. Stated another way, we predict that the valence of attributions towards ritualized objects will be congruent with the valence of attributions to the group (though we still expect attributions of ‘specialness’ to remain high, as ‘specialness’, in the lay-sense, is not limited to positive contexts).

Methods.

Participants. A total of 353 participants were recruited via mTurk. The sample consisted of 163 female and 189 male participants (with 1 missing value), who ranged in age from 18 to 92 years ($M = 35.29$, $SD = 11.79$), and who overwhelmingly reported English as their native language (98.6%). A total of 45.0% reported completing a tertiary degree and a further 10.2% reported holding a Post-graduate degree, while 30.7% reported ‘some tertiary’. Of the remaining participants, 13.6% completed high school while only .3% reporting ‘some high school’; there was 1 missing values (0.3%). 43.8% of participants earned less than \$25,000(US) a year, 17.0% earned between \$25,001 and \$35,000, and 10.5% earned between \$45,001 and \$55,000 (all of whom accounted for 80.7% of the sample), the remaining 19.2% reported earning in

excess of \$55,001 annually.

Materials. The materials employed in Experiment 2 were identical to those employed in Experiment 1, except for one difference. While the same videos were presented to participants, we altered the nature of the contextual information. Instead of describing three relatively obscure and neutrally valenced rituals (i.e., Kava, Bwititi, and Ayuahasca) we described more aversive rituals. Using the same written form, “*This video contains elements of established ritual seen around the world. The actions in this video can be seen in [ceremony name] of [Location]*”, we described each video as representing Satanic Ritual (North America), Voodoo Ritual (Caribbean Sea) or Wicca/Witchcraft Ritual (British Isles).

Design, Procedure and Coding. As per Experiment 1, participants were randomly assigned to one of four conditions: 1) Ritual with no context, 2) Ritual with context, 3) Control actions with no context, or 4) Control actions with context. The procedure and coding were identical to Experiment 1.

Did participants perceive drinks as ‘the same’? Data on the ‘same’ variable was coded such that one point was assigned to a response in which the participant indicated that the glasses were different. Thus, across two trials, if a participant said that the glasses are different on both trials, they had a total score of 2 (corresponding to category 2 – ‘Glasses the same on both trials’). All ‘same’ analysis returned a null result on the Test of Parallel Lines ($p > .05$) and satisfied the assumption of proportional odds, indicating OLR was an appropriate statistical tool.

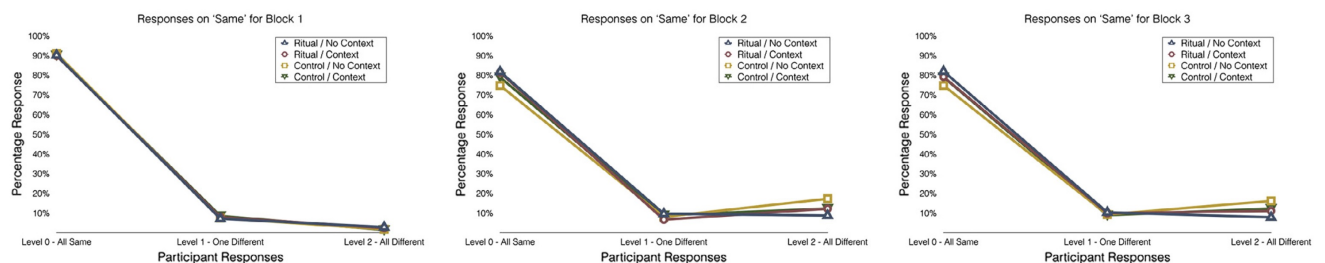
Across all blocks (two glasses one action, three glasses one action, and three glasses two actions) we found that our OLR did not provide a better fit than the general model. In Block 1 the final model fit was not significant, $\chi^2(2) = .274$, $p = .696$, nor was the model fit in Block 2 $\chi^2(2) = .701$, $p = .704$, nor was the model fit in Block 3, $\chi^2(2) = .650$, $p = .723$. In all cases this indicates that a model with predictors is not better than a general model without predictors. See table 6 for specific values. Figure 5 shows the proportion of responses in each category across all four conditions.

Table 6

Parameter estimates of ordinal logistic regression for ‘same’ scores for all three blocks of stimuli

Predictor	Log Odds	SE	Wald’s χ^2	<i>p</i>	95%CI	Odds Ratio
<i>Block 1: Two Glasses One Action</i>						
Opacity (1) vs Transparency (0)	-0.119	0.214	0.310	0.557	-0.539 - 0.300	-
Context (1) vs No Context (0)	-0.137	0.214	0.411	0.521	-0.556 - 0.282	-
<i>Block 2: Three Glasses One Action</i>						
Opacity (1) vs Transparency (0)	-0.074	0.256	0.085	0.771	-0.577 - 0.428	-
Context (1) vs No Context (0)	-0.202	0.256	0.622	0.410	-0.704 - 0.300	-
<i>Block 3: Three Glasses Two Actions</i>						
Opacity (1) vs Transparency (0)	-0.069	0.251	0.075	0.785	-0.985 -	-
Context (1) vs No Context (0)	-0.192	0.251	0.584	0.445	-0.685 - 0.301	-

Figure 5. Responses as a percentage of total responses on ‘same’ variable across all blocks.



Did participants perceive ‘specialness’ among the drinks?. Data on the ‘special’ variable was coded such that one point was assigned to a response in which participants reported that one of the glasses was special. Thus, across two trials, if a participant said one of the glasses was special on both trials, they had a total score of 2 (corresponding to category 2 – ‘specialness present on both trials’). All ‘special’ analyses returned a null result on the Test of Parallel Lines ($p > .05$) and, thus, satisfied the assumption of proportional odds, indicating OLR was an appropriate statistical tool.

In Block 1 (two glasses one actions) we found a significantly better final model fit,

$\chi^2(2) = 12.536$, $p = .002$, indicating that a model with predictors was better than a model without predictors. Pearson's Goodness-of-fit, $\chi^2(4) = 2.980$, $p = .561$, did not fall below the threshold ($p < .05$). As Table 7 shows, when actions are opaque, participants are 1.48 times more likely to report the presence of specialness at each [increasing] level of the DV. Likewise, when context is present, participants are 1.83 times more likely to report the presence of specialness at each [increasing] level of the DV. Pseudo- R^2 values range from .017 (McFadden) to .040 (Nagelkerke).

In Block 2 (three glasses one actions) we found a significantly better final model fit, $\chi^2(2) = 32.028$, $p < .001$, indicating that a model with predictors was better than a model without predictors. Pearson's Goodness-of-fit, $\chi^2(4) = 7.316$, $p = .120$, did not fall below the threshold ($p < .05$). As Table 7 shows, when actions are opaque, participants are 3.02 times more likely to report the presence of specialness at each [increasing] level of the DV. Likewise, when context is present, participants are 1.74 times more likely to report the presence of specialness at each [increasing] level of the DV. Pseudo- R^2 values range from .048 (McFadden) to .102 (Nagelkerke).

In Block 3 (three glasses two actions) we found a significantly better final model fit, $\chi^2(2) = 16.463$, $p < .001$, indicating that a model with predictors was better than a model without predictors. Pearson's Goodness-of-fit, $\chi^2(4) = 2.179$, $p = .703$, did not fall below the threshold ($p < .05$). As Table 7 shows, when actions are opaque, participants are 1.66 times more likely to report the presence of specialness at each [increasing] level of the DV. Likewise, when context is present, participants are 2.07 times more likely to report the presence of specialness at each [increasing] level of the DV. Pseudo- R^2 values range from .026 (McFadden) to .055 (Nagelkerke). Figure 6 shows the proportion of responses in each category across all four conditions

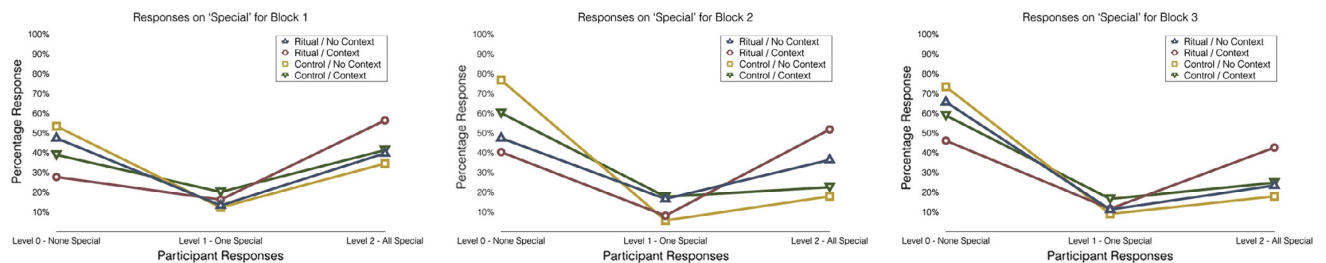
Which drink did participants select to drink?. Data on the 'drink' variable was coded such that one point was assigned to a response if the participant chose [one of] the acted upon glasses. Thus, across two trials, if a participant chose an acted upon glass on both trials, they had a total score of 2 (corresponding to category 2 – 'chose acted-upon objects exclusively'). All 'drink' analyses returned a null result on

Table 7

Parameter estimates of ordinal logistic regression for ‘special’ scores for all three blocks of stimuli

Predictor	Log Odds	SE	Wald’s χ^2	<i>p</i>	95%CI	Odds Ratio
<i>Block 1: Two Glasses One Action</i>						
Opacity (1) vs Transparency (0)	-0.395	0.203	3.775	0.052	-0.793 - 0.003	1.484
Context (1) vs No Context (0)	-0.604	0.204	8.794	0.003	-1.003 - -0.205	1.829
<i>Block 2: Three Glasses One Action</i>						
Opacity (1) vs Transparency (0)	-1.104	0.218	25.729	< .001	-1.531 - -0.678	3.016
Context (1) vs No Context (0)	-0.553	0.215	6.610	0.010	-0.975 - -0.132	1.738
<i>Block 3: Three Glasses Two Actions</i>						
Opacity (1) vs Transparency (0)	-0.507	0.218	5.432	0.020	-0.934 - -0.080	1.660
Context (1) vs No Context (0)	-0.727	0.218	11.129	< .001	-1.155 - -0.300	2.069

Figure 6. Responses as a percentage of total responses on ‘special’ variable across all blocks.



the Test of Parallel Lines ($p > .05$) and, thus, satisfied the assumption of proportional odds, indicating OLR was an appropriate statistical tool.

In Block 1 (two glasses one actions) we found a significantly better final model fit, $\chi^2(2) = 12.740$, $p = .002$, indicating that a model with predictors was better than a model without predictors. Pearson’s Goodness-of-fit, $\chi^2(4) = 2.494$, $p = .646$, did not fall below the threshold ($p < .05$). As Table 8 shows, when actions are opaque, participants are 2.03 times more likely to report the presence of specialness at each [increasing] level of the DV. No effect of context was observed. Pseudo- R^2 values range

from .017 (McFadden) to .040 (Nagelkerke).

In Block 2 (three glasses one action) we found a significantly better final model fit, $\chi^2(2) = 12.468$, $p = .002$, indicating that a model with predictors was better than a model without predictors. Pearson's Goodness-of-fit, $\chi^2(4) = 7.141$, $p = .129$, did not fall below the threshold ($p < .05$). As Table 8 shows, when actions are opaque, participants are 2.02 times more likely to report the presence of specialness at each [increasing] level of the DV. No effect of context was observed. Pseudo- R^2 values range from .003 (McFadden) to .006 (Nagelkerke).

The model fit for Block 3 with predictors was not better than the general model without predictors. No effects of action type nor context was observed. Figure 7 shows the proportion of responses in each category across all four conditions.

Table 8

Parameter estimates of ordinal logistic regression for drink preference scores for all three blocks of stimuli

Predictor	Log Odds	SE	Wald's χ^2	p	95%CI	Odds Ratio
<i>Block 1: Two Glasses One Action</i>						
Opacity (1) vs Transparency (0)	-0.706	0.202	12.149	< .001	-1.102 - -0.309	1.484
Context (1) vs No Context (0)	-0.131	0.201	0.425	0.515	-0.524 - 0.262	-
<i>Block 2: Three Glasses One Action</i>						
Opacity (1) vs Transparency (0)	-0.202	0.218	12.238	< .001	-1.100 - -0.310	2.024
Context (1) vs No Context (0)	0.050	0.020	0.062	0.803	-0.343 - 0.442	-
<i>Block 3: Three Glasses Two Actions</i>						
Opacity (1) vs Transparency (0)	0.202	0.197	1.058	0.304	-0.134 - 0.589	-
Context (1) vs No Context (0)	0.179	0.197	0.828	0.363	-0.207 - 0.565	-

Table 9

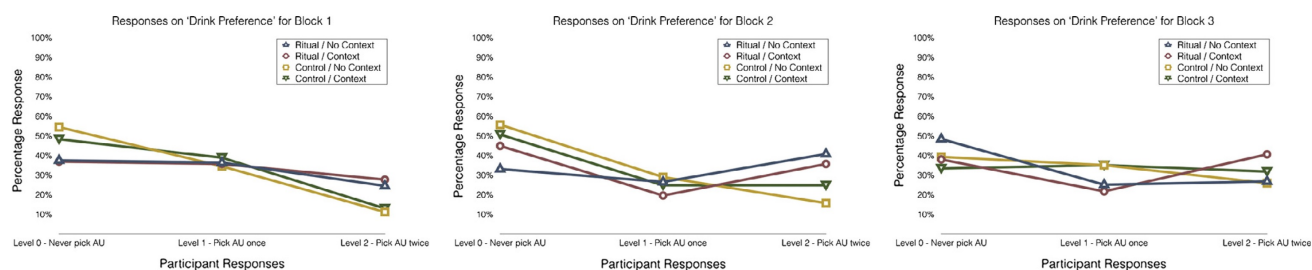
Table of correlations between survey items and DV's in Experiment 1 (combined populations: $N = 353$)

Scale	1	2	3	4	5	same	same	same	special	special	special	drink	drink	drink
						Block 1	Block 2	Block 3	Block 1	Block 2	Block 3	Block 1	Block 2	Block 3
1 History of Religious and Ritual Exposure	-	0.418**	-0.093	0.190**	0.560**	-0.004	-0.072	-0.071	0.046	0.074	0.52	-0.035	0.007	0.007
2 Paranormal Beliefs	-	-	-0.234**	0.356**	0.518**	0.070	-0.054	-0.116*	0.073	0.078	0.078	0.035	0.031	0.035
3 Rational Thinking Style	-	-	-	-0.032	-0.146*	-0.107*	-0.041	0.051	-0.061	-0.043	-0.061	-0.054	-0.091	-0.035
4 Intuitive Thinking Style	-	-	-	-	0.121*	0.078	0.002	-0.052	0.072	-0.033	0.061	0.017	0.028	-0.040
5 Religiosity	-	-	-	-	-	0.027	-0.009	-0.043	0.073	0.045	0.004	-0.025	-0.002	-0.028

< .001. (two-tailed)

* $p < .05$; ** p

Figure 7. Responses as a percentage of total responses on ‘drink’ variable across all blocks.



Discussion. Results of Experiment 2 mirror those of Experiment 1. Across all conditions and blocks of stimuli, neither action-type nor presence of context improved a general predictive model on measures of sameness. In Experiment 1, opacity lead to an increased likelihood that participants would rate objects as different in Block 3 – this effect was not replicated in the present experiment. As with Experiment 1, action-type and context generated significant differences in status attributions. Opaque actions made it considerably more likely that participants would report the presence of specialness within the object set (OR between 1.48 and 3.02), and the presence of context had a similar influence (OR between 1.74 and 2.07). On average, opaque actions increased this likelihood more than the presence of context.

We expected participants to avoid objects when they were described as Satanic, Voodooistic, or Wiccan, irrespective of action-type, due to the aversive nature of the context. This was not the case. Describing ritual and control actions in these terms did not reverse the trend identified in Experiment 1. That is, we predicted that the presence of aversive context would make it less likely (i.e., an $OR < 1$) that participants would prefer these objects. Instead, we found no significant influence of context on likelihoods of choice whatsoever. We still observed (in Block 1 and 2) that ritual actions increased the likelihood of exclusive preference for acted-upon objects. We observed no effects in block 3.

While our hypotheses were not fully supported, all data are interpretable within the framework of the ritual stance. Ritual actions with causal opacity (with no

'knowable' physical-causal relationship) were not more likely to be reported as physically different from objects subjected to transparent actions (indeed, neither action-type appeared to influence physical attributions of the object). However, the presence of opacity lead to 'special' object-attributions, which in turn, lead to greater preference for acted upon objects. Unlike Experiment 1, providing context, which served a normative cue (i.e., these actions are the actions of a specific group of people) had neither a positive nor a negative effect on preference – despite the fact we predicted a pattern of avoidance. This supports predictions derived from the ritual stance which describe a normative interpretation of ritual actions, and which are more deeply discussed in the General Discussion.

General Discussion

Rituals of various forms are deeply embedded in all human cultures. At one extreme, rituals are understood as elements within institutions (such as religions), and at the other extreme, are understood as a process by which ordinary actions are divorced of their initial [potentially instrumental] purpose to become what we recognize as rituals (Boyer & Liénard, 2006; Liénard & Boyer, 2006; McCauley & Lawson, 2002; Whitehouse & Laidlaw, 2004). This can sometimes make them difficult to identify. It intuitively feels odd to draw comparisons between singing hymns and singing the national anthem, lighting candles in a vigil and lighting Christmas decorations, and making 'magic' potions and making tea. Why do we sing for gods and country, why do we light our homes to honor both a family memory and a childhood lie, and why are particular actions demanded for particular drinks? In isolation these actions are opaque – they do not cause an actual physical change in the real world, nor is any inference of physical-cause change valid, and yet we recognize that these actions have significance, and may influence our social and psychological worlds. Here we have presented results and argued that ritual acts, by virtue of their causal, instrumental and motivational opacity, convey socially important normative information. Moreover, while minimal context helps us place a ritual act within a normative social framework, we are still able

to infer the significance of an act even when that context is denied to us, allowing us to alter our behaviour. Indeed, on average, the influence of opacity has a larger influence on the likelihood of special attributions and preference than does the presence of context.

In both Experiment 1 and 2, participants recognized that objects were not physically changed, irrespective of whether an opaque ritual acts or a transparent control act was performed. Yet in both experiments opaque acts increased perceptions that a set of objects were imbued with something ‘special’. Providing some social context (i.e., describing an act as belonging to a ritual and a group of people) served to enhance this effect. Finally, opaque ritual acts continued to increase participants’ preference for consuming acted-upon objects – accounting for variance when the ritual was accompanied with descriptions of relatively unknown and neutrally valenced groups (Bwiti, Kava, or Ayahuasca) and when accompanied by recognizably aversive groups (Satanic, Wiccan, or Voodooistic). These results support predictions derived from the ritual stance: when confronted with opaque, ritual actions, we interpret them through a normative, social lens.

Two findings need further consideration: how rituals influence perception and behaviour, and why aversive contexts did not systematically and negatively influence preferences as predicted. In the first instance, we methodologically controlled for the possibility that singling acts may lead to interpretations consistent with the ritual stance. Our data provide tentative evidence that, in Block 3 (across both experiments), participants’ tendency to choose the acted-upon object was diminished when the object singled out was not the object acted upon. While opaque actions tend to make objects special, singling out objects by ignoring them in the context of other actions (including transparent actions) also appears to influence self-reported behaviour. This can be interpreted in two non-exclusive ways.

First, we may privilege the inner state of the performer above the physical effect they are trying to bring about. When the motivation of the demonstrator is opaque (*why did he leave that drink alone when he acted on the others?*), we may be more

motivated to rely on a mental/cognitive heuristic than a causal heuristic (*he must have a reason, even if I don't know it*). This is consistent with the ritual stance. Second, the way in which we, as observers, demarcate ritual acts may be important. In Block 3, participants may infer that the ritual begins when the first small glass is moved forward, and ends after the bow. Under such conditions the most salient aspect was the unexplained avoidance of a single object within the complete sequence. Alternatively, in Blocks 1 and 2, participants may focus on the individual elements of ritual (the waving, humming, gesturing, and bowing) rather than perceiving the whole sequence as a complete ritual – in which case the ritual acts are the singling acts. Here rituals are performed within a larger sequence, rather than the larger sequence constituting a whole ritual. Our data do not allow us to resolve this question satisfactorily, but do provide weak evidence that participants may be employing the latter strategy – given that the likelihood of picking an acted-upon object was not improved in Block 3 in Experiment 2 (using an OLR), and may have had a slightly negative influence on likelihood to pick acted-upon objects in Block 3 of Experiment 1.

Importantly, the afore-noted results are in stark contrast to the influence opacity has in Block 1 and Block 2 for acted-upon objects. Recently published data by Nielsen, Kapitány, and Elkins (2014) suggest – at least in children – that ritualistic actions are understood in isolation, rather than as part of a larger coherent sequence. Work by Nielbo, Schjødt, and Sørensen (2013); Nielbo and Sørensen (2011); Zacks et al. (2004) also suggests that when the physical-causal relationship is not immediately discernible participants tend to group actions within a sequence into smaller chunks than equivalent actions in a sequence that does afford a physical-causal relationship. We thus argue that the change in participants' response in Block 3 is explained by this grouping-strategy: action-parsing within rituals tends towards smaller discrete action-units, rather than towards an integrative whole. By singling out an object within a whole (even through inaction) we find participants making different attributions regarding intended outcomes or consequences. This emerging data points to a more complicated and nuanced picture of ritual cognition, which provides a range of

interesting opportunities for future research.

It is surprising that rituals with a neutrally valenced context lead to similar outcomes as rituals described as Satanic, Voodooistic, or Wiccan. Proponents of the ritual stance predict that ritual acts are interpreted as normative and socially relevant. That said, the theory makes no predictions regarding qualities of arousal or valance. If we are to assume, all things being equal, that all rituals are approximately equally socially normative and informative, irrespective of the valence, then we do not have just cause to predict a reversal of preference. However, if rituals play a role in regulating and expressing the beliefs and values of groups and group members (Atran & Henrich, 2010; Ensminger, 1997; Henrich, 2009; Konvalinka et al., 2011; Reddish et al., 2014; Ruffle & Sosis, 2007; Sosis & Bressler, 2003; Sosis & Ruffle, 2003; Wiltermuth & Heath, 2009) then we ought to be relatively calibrated to identifying the rituals of groups that we do not belong to, or which we find aversive. For example, a member of one community may avoid a ritualized object from another community, but nonetheless recognize the object in question as significant (and possibly desirable) for those in that group. On the one hand, it's possible that the same action (avoidance) might reflect prejudiced motivations, but on the other, reflect intergroup sensitivity (as we may not fully understand the rules surrounding the ritualized object and wish to avoid causing offence). We must keep in mind that while some participants knew to whom the ritual belonged, they did not know what purpose the ritual served – perhaps leading to an unaccounted for set of participant assumptions.

However, there is an alternative explanation for our results. Our rituals were novel, emphasized opacity, and were focused on something edible - it is possible that food has a privileged position with respect to ritual actions – such that it uniquely becomes desirable. Vohs et al. (2013) asked participants to watch and perform ritual acts on chocolate bars, lemonade, and carrots. They found that ritual acts (compared to no act) made chocolate and lemonade more flavorful, valuable, and more worthy of savoring. They also found that such effects did not manifest if the performed acts were perceived as random, rather than ritualistic. With regard to our results, it's possible,

then, that rituals make objects (particularly foodstuffs) desirable, and the valence of the context matters little (as seen in Experiment 2). We hypothesize that if a purpose for the ritual was assigned (i.e., ‘this ritual is a curse and is personally harmful vs. ‘this ritual is a blessing and personally beneficial’) then we may see the effect moderated.

How are we to interpret the results in relation to the social-action hypothesis (J. Barrett & Lawson, 2001; Lawson & McCauley, 1990; Sørensen et al., 2006)? As described previously, we argue that the work by Sørensen et al. (2006) and by J. Barrett and Lawson (2001) are somewhat hamstrung by (a) not directly addressing participant experience, but rather what they believe about others’ beliefs, and (b) by prescribing a premise and participants logically applying the premise to produce a conclusion. We found that variation in participants’ responses were uniquely explained by both action-type and context, and yet it did not seem to matter whether the rituals were recognizable or not, or whether they were apparently neutrally valenced or not; again, no supernatural agents were referenced. When we asked participants whether they thought any objects were ‘special’ we deliberately left the term undefined, unlike Barrett and Lawson who defined it with reference to the authority and power of a supernatural agent. While it seems inevitable that participants would understand ‘special’ in this study differently from earlier studies, it is not necessarily clear that this is problematic. Indeed, we found that participants’ naturally attributed some kind of status-change (i.e., specialness) to objects. We do not have sufficient data to determine whether or not a reference to the supernatural would increase the observed effect, or whether it could account for additional variance that natural (i.e., not supernatural) explanations miss. That said, our methodology avoids invoking participants’ preconceptions (by way of video rather than vignette), avoids second-order attributions, and avoids both double-barreled questions and leading primes.

We argue the ritual stance – that rituals are interpreted with reference to social normativity – is more parsimonious than the social-action hypothesis – in which rituals are interpreted with reference to supernatural authority recognized by natural agents. To further this point, we observed that objects that were singled-out and made

desirable by virtue of not being acted upon couldn't—logically—have been made so by the authority of any inferred supernatural authority. If, as Lawson and McCauley (1990), Sørensen et al. (2006) and J. Barrett and Lawson (2001) predict, the agent or act is the tool by which ritual effect is brought about, then not performing a ritual can't possibly result in the described ritual-outcome. Critically, it is worth noting that, despite the intuitively large Odds Ratios, the Psuedo- R^2 values (which we can, in a rough sense, interpret as a measure of variance accounted for by the model) reach a maximum of 10.2%. There has been considerable debate about the appropriateness of this measure, primarily due to its highly responsive nature to multiple inputs, and it's somewhat conservative nature compared to R^2 (see (McFadden, 1974). That said, if we are to assume that Psuedo- R^2 gives us an estimate, our model does not explain a great deal of variance. However, this should not be surprising given the incredibly impoverished nature of our stimuli compared to phenomena observed in the real world. That we found an effect at all using a procedure administered online via mTurk (see: Buhrmester, Kwang, and Gosling (2011); Casler, Bickel, and Hackett (2013)) for a discussion on mTurk), which required participants to make hypothetical judgments about consumption, may actually be taken as a demonstrable proof-of-concept. Future research employing this paradigm under lab conditions employing face-to-face testing will resolve the true extent of this phenomenon.

It is also worth noting here that a quirk of our procedure could be perceived as accounting for the data we report. That is, at first glance it may appear that in the control conditions the experimenter touches a glass, something they do not in the ritual conditions, potentially resulting in a contamination avoidance effect in the case of the former. However, we do not believe contamination is an issue. First, in all conditions, across all blocks, all glasses were touched by the demonstrator (when the demonstrator moved the glasses forward into a more prominent position). Thus, to avoid a glass which had been touched is not practically possible. Second, since contamination is a physical property, and we found that, when participants were asked whether the glasses were the same/identical, neither opaque nor transparent acts altered the likelihood that

objects were reported as being different. Thus, in the participants' own responses, we find evidence against the claim they are motivated by a contagion. Finally, even if the results could be explained by appealing to a contagion on the acted upon glasses, the evidence provided that context increases likelihood of choosing the acted-upon glass in both opaque and transparent conditions would be incongruent. The ritual stance predicts a normative response, and our evidence from both motor- and semantic-cues parsimoniously supports this claim. Further research, which employs artifacts/objects which are less susceptible to contamination, would clarify this point, though we do not believe there is a strong theoretical reason to reverse our predictions under such circumstances.

By way of conclusion, consider a ritual many of us are familiar with: the birthday party. If we strip away the rich beliefs surrounding the act, what transpires is actually rather odd. A group begins chanting in synchrony toward a specific individual (on a very specific day), independently, someone retrieves a uniquely adorned item of food, sets it on fire, and delivers it to the group as the chanting climaxes. A singular individual within the group, organically determined in the moment, begins a second, shorter chant in an A-B format (and repeats it three times), before the central individual breathily puffs all over the food. Everyone cheers a third time (this time without structure and for a briefer duration) and bangs their hands together making noise. Now ask the following question: Under what circumstances would you eat such food? Would you happily oblige if this is how steak-and-chips were routinely delivered? Would you drink a glass of wine that had been breathily sanctified? Once our expectations have been stripped away, the difference is not in whether a birthday cake is more or less hygienic or its arrival is more or less bizarre, but in our understanding of the significance of the strange and apparently inexplicable acts that surround it. To be naïve to an observed ritual act is to search for meaning and interpretation, either in light of intended or expected outcomes (if any are available), or with reference to the performer's motives. Under such circumstances we may find ourselves lost for explicit explanation. This deficit (or gap), generated by causal-, instrumental-, or

motivational-opacity, is subsequently interpreted naturally – these actions must be relevant; they are socially informative, and are likely socially normative, and they may beget a change in behaviour. We need not know why a thing is done, nor what the expected outcome is, just that here and now this is what people are doing, and we should act in accordance with the group's expectations. Thus, we eat the cake, not in spite of its strange preparation, but because of it, and because it's expected by all those around us.

Chapter Two: The Ritual Stance and the Precaution System: The role of goal demotion and opacity in ritual and everyday actions

Preface

The present empirical chapter was first published in *Religion, Brain and Behaviour* in 2016. It is presented without change (save for factual corrections that do not change the methods, results, or analysis in any way; as well as changes made to ensure consistent terminology). The purpose of this chapter was to extend the findings presented in the previous chapter. Specifically, we wanted to more directly manipulate how goal demotion, as a theoretical construct, interacted with established patterns of behaviour associated with ritualized actions and objects.

Abstract

Rituals tend to be both causally opaque and goal demoted, yet these two qualities are rarely dissociated in the literature. Here we manipulate both factors and demonstrate their unique influence on ritual cognition. In a 2 x 3 (Action-Type x goal-information) between subjects design 484 US adults viewed causally opaque (Ritual) or causally transparent (Ordinary) actions performed on identical objects. They were provided with no goal information, positive goal information ('Blessing') or negative goal information ('Cursing'). Neither causal opacity nor goal information influenced perceptions of physical change/causation. In contrast, causal opacity increased attributions of 'specialness', whereas goal-information did not. Finally, goal-information interacted with action-type on measures of preference, such that ordinary actions are influenced by both 'blessings' and 'curses', but ritual actions are only influenced by 'curses'. These findings are interpreted in light of the ritual stance, and the cognitive bases of the effects are described with reference to Boyer and Liénard's Precaution theory of ritualized behaviour. The combined value of these two theories is discussed, and extended to a causal model of developmental ritual 'calibration'

Introduction

Ritual-like behaviour appears to have been a part of the Homo behavioural repertoire for tens of thousands of years, with evidence of Neandertal burial dating back 30kya (Rendu et al., 2014). The ubiquity of such actions in modern Homo sapiens, and their general absence in our closest living relatives, suggests an adaptive role. Rituals solve evolutionary and cultural problems, including bonding and cooperation (Konvalinka et al., 2011; Legare & Nielsen, 2015; Reddish et al., 2014; Wiltermuth & Heath, 2009), commitment to group values (Ensminger, 1997; Henrich, 2009; Irons, 2001; Ruffle & Sosis, 2007; Sosis & Ruffle, 2003), and transmission of normative and cultural information (Atran & Henrich, 2010; Chudek & Henrich, 2011; Rossano, 2012; Schjødt & Sørensen, 2013; Sosis & Bressler, 2003). While the effects of ritual are well documented, less is understood regarding the cognitive mechanisms that bring these effects about. Ritualized actions can be recognized for their repetition, redundancy, stereotypy, and formality (Boyer & Liénard, 2006; Bulbulia & Sosis, 2011; Eilam, Zor, Szechtman, & Hermesh, 2006; Legare & Souza, 2012; Rappaport, 1999; Rossano, 2012). Such actions also feature causal opacity and goal demotion: qualities which can apply to the whole sequence of actions ('ritual'; (Nielbo & Sørensen, 2015; Sørensen & Nielbo, 2013). While many ordinary behaviours embody these qualities (as with the repetition of cleaning, or the formalities of social life) rituals feature these qualities in conjunction and often without instrumental justification. In the absence of a rich exegetical history associated with particular actions (as is often the case with religious rituals) both causal opacity and goal demotion, which are common qualities of many rituals, allow observers to identify an action sequence as a ritual rather than as an ordinary alternative (Nielbo & Sørensen, 2015; Sørensen & Nielbo, 2013), thus cuing different behavioural and cognitive responses.

However, not all rituals are created equal. Rituals may not be causally opaque, nor goal demoted (nor do they always occur simultaneously). Religious rituals, for example, typically have a great deal of history and exegetical justification (which means they are not goal demoted), and may involve instrumental outcomes, such as making

something clean (which means they are causally transparent). Hereafter, we refer to the phenomenon under consideration as ritualized behaviour (as defined in the first paragraph) and refer to sequences of ritualized behaviours, not as ‘rituals’, but as ritualized actions. This terminology has been used in order to avoid confusion or conflation with other kinds of ritual, particularly religious rituals.

Causally opaque actions (like crossing one’s fingers for good luck) deny observers intuitive access to the mechanism by which the action causes an effect. According to a number of authors such actions obfuscate instrumental interpretations due to a “*decoupling of an action sequence’s causal dependency structure*” (Kapitány & Nielsen, 2015; Legare & Wen, 2014; Legare, Whitehouse, et al., 2015; McGuigan et al., 2011; Nielsen, Kapitány, & Elkins, 2014; Schjødt & Sørensen, 2013; ?). Conversely, causally transparent (ordinary) actions can be easily and intuitively understood (as is the case with hammering a nail into wood). While causal opacity describes whether or not an action sequence has an observable potential mechanism, goal demotion refers to an observer’s ability to infer and understand an actor’s reason (e.g., goals or motivations) for a given action sequence (Boyer & Liénard, 2006; Keren et al., 2013; Liénard & Boyer, 2006; Nielbo & Sørensen, 2011,?; Schjødt & Sørensen, 2013). Put simply, causal opacity begets the question ‘by what mechanism is an effect being caused’ while goal demotion begets ‘Why does the actor act?’. Rituals tend to be both opaque and goal demoted, and as a result, are rarely dissociated in the literature.

When we perceive an action as opaque and goal demoted we recognize it as deliberate (not incidental or accidental) and adopt the ritual stance; via conventional and affiliative motives we make normative and social inferences which inform our subsequent behaviour (Herrmann et al., 2013; Legare & Souza, 2012; Nielsen, Kapitány, & Elkins, 2014). This has been demonstrated in children (Diyanni, Corriveau, Kurkul, & Nasrini, 2015; Herrmann et al., 2013; Legare, Wen, et al., 2015; Nielsen, Kapitány, & Elkins, 2014) and adults (Ensminger, 1997; Henrich, 2009; Irons, 2001; Ruffle & Sosis, 2007; Sosis & Ruffle, 2003). Furthermore, artificial neural networks have been shown to learn how to discriminate between ritualized and non-ritualized action sequences

(Nielbo & Sørensen, 2015; Sørensen & Nielbo, 2013). But what are the proximate and ultimate explanations for discriminating between ritualised actions and non-ritualized actions? What cognitive mechanisms or systems are responsible?

According to Boyer and Liénard (2006) and Liénard and Boyer (2006) ritualized behaviour constitutes the elements of ritual. They argue that ritualized actions are ‘partly parasitic’ on cognitive systems adapted to serve other purposes and that cultural rituals are a by-product. These systems, identified respectively as the hazard precaution and the action parsing system, are design to detect inferred threat and potential harm to protect the organism, but misfire in the case of ritualized action . The ‘proper functional range’ of activation is a range of stimuli calibrated by evolution adaptive to the organism, while the ‘actual domain’ includes an extended range of stimuli, not shaped by evolution, which share a sufficient number of features with ‘proper’ stimuli. For example, children may adaptively avoid dangerous foods by virtue of taste cues - like bitterness - but may incorrectly reject palatable food - like broccoli - as a result (Wardle & Cooke, 2008). The hazard precaution and action parsing systems are calibrated to respond to inferred threat via cues in the behaviour of others who are directly responding to legitimate threats. For example, the proper range of activation for hazard precaution may include responding to others’ behaviour as they respond to pathogen or social threat. To illustrate: observing a response to pathogen threat may include observing deliberate repetitive cleaning and caution (in the form of stereotypy); observing a response to social threat may include imitation/synchrony, submission/supplication, or conformity (Watson-jones, Busch, & Legare, 2016).

Ritualized actions share many features and cues with ‘proper’ threat response, and tend to disrupt the level at which the actions are analysed and interpreted, arresting the system, a phenomenon known as ‘cognitive capture’ (Boyer & Liénard, 2006; Liénard & Boyer, 2006; Nielbo et al., 2013; Zacks et al., 2004, 2007). There are three hierarchical levels of action parsing: ‘Scripts’ ‘Behaviour’, and ‘Gesture’. The default

²A great deal has been written on action parsing independent of these authors. See (Nielbo et al., 2013; Nielbo & Sørensen, 2015; Sørensen & Nielbo, 2013; Zacks et al., 2004, 2007)

level is behaviour. For example, you might observe someone in a kitchen and describe their behaviour as cleaning a glass, because you can intuit the actor's intentions and the mechanisms of action. This contrasts with Gesture. Here, the same actions are parsed discretely as [raising a glass], [grasping a cloth] and [rubbing the glass with a cloth]. Scripts generate a broader description, like 'preparing lunch' or 'cleaning the kitchen'. When the action-elements involved in cleaning a glass are used in such a way as to prevent an instrumental outcome we shift down to [gesture]. For example, we cannot say someone is cleaning if a cloth, despite being moved in a cleaning motion, is never brought into contact with the glass. Thus, we automatically parse the actions discretely as [raising a glass] [grasping a cloth] and [waving the cloth in the air].

Our systems are arrested when cognitive predictions are disrupted by error-checking processes. When actions are goal demoted and causally opaque we are forced to parse at a gestural, rather than a behavioural, level (Schjødt & Sørensen, 2013; Watson-jones et al., 2016; Zacks et al., 2001). However, we are motivated to return to the default level of interpretation, and so we attempt to attribute and infer meaning (Herrmann et al., 2013; Legare & Souza, 2012; Nielbo & Sørensen, 2015; Rossano, 2012; Schjødt & Sørensen, 2013; Sørensen & Nielbo, 2013). Causal opacity has been discussed in the literature in depth (Kapitány & Nielsen, 2015; Nielsen, Kapitány, & Elkins, 2014; Schjødt & Sørensen, 2013; Watson-Jones et al., 2014). In a recent study Kapitány and Nielsen (2015) showed that objects subjected to opaque actions were reported as more special and desirable compared to objects subjected to transparent actions. Providing benign social context increased this effect, while aversive context had no influence. They concluded that ritualized actions are interpreted normatively. Unlike causal opacity, goal demotion has been less explored (but see: (Keren et al., 2013; Mitkidis et al., 2014; Nielbo & Sørensen, 2015; Sørensen & Nielbo, 2013).

In the current study we directly manipulate and dissociate causal opacity and goal demotion. Participants were shown a series of videos featuring an actor performing actions on sets of identical glasses containing an amber liquid. Actions were presented as either ritualistic (causally opaque) or ordinary (causally transparent) and were

accompanied with a description of the actor's intentions ('goals') as either a blessing or a curse, or were left without a description. We chose to employ two opposite-valence goals in order to better assess the magnitude of any potential effect (as we anticipate they will elicit different responses). All actions were described as belonging to a specific benign ritual tradition. After viewing the videos participants responded to questions addressing whether each glass was the 'same' and/or 'special', and which they'd most like to drink from.

Our predictions derive from the ritual stance (that ritualistic actions are interpreted normatively). We hypothesised that objects subjected to ritualized actions (opaque actions) would be rated as more special and desirable (i.e., they would be chosen as the glass to drink from) than objects subjected to ordinary (transparent) actions. Additionally, compared to no goal information, blessings (positive goal information) would increase desirability, and curses (negative goal information) would decrease it. We made no predictions regarding the 'same' question, as this question primarily serves as an attention-check Kapitány and Nielsen (2015) found judgements of 'sameness' to be unaffected by the types of actions presented).

Methods

Participants. Participants were recruited via mTurk and were offered \$1.20(US) for their time. Based on the methods and analyses of Kapitány and Nielsen (2015), and an informal p-curve analyses conducted on those findings (unpublished), we made an a priori decision to attempt to collect 100 participants per cell. Data was collected in a single wave, and no *ad hoc* decisions were made to alter the desired N. A total of 694 people accepted the initial HIT, but 170 immediately dropped out. A further 22 completed less than 51% of the key questions and were omitted from the final dataset. Finally, we deleted 19 participants from condition 5 (Ordinary / Blessing), as experimenter error compromised their data (they were accidentally given a question from condition 3 – Ritual / Blessing). The final sample comprised 484 participants (Mean age = 34.34 years, SD = 11.18). Of these, 41.5% completed a tertiary degree,

10.4% held a Post-graduate degree, 29.0% reported some tertiary education, and 18% had only completed high school, 1% reporting ‘some high school’ and 1 participant did not provide a response. The majority of participants (48.3%) earned less than \$25,000(US) annually, 13.3% earned between \$25,001 and \$35,000, and 18.5% earned more than \$45,001 annually. Participants comprised 57.6% males and 42.2% female (with one value missing; note that we also provided a third option, ‘other’, for gender. It was not used). Possible gender effects were examined in analyses (upon peer-review) but did not indicate any cause for concern, as a result, all analyses disregard gender information.

Procedure. Participants were briefed and randomly assigned to one of six conditions that varied by Action-Type (either Ritual or Ordinary actions) or Goal-type (Blessing, Curse, or Goal-Absent). They first completed a basic demographic survey, then, over three blocks of stimuli, watched six videos (two per block) in which a male adult acted on glasses containing an amber liquid. After viewing each video participants responded to the same questions: ‘Are the drinks the same?’, ‘Is either/any drink special? If so, which one?’, and ‘Which drink would you select to drink?’. After viewing all videos, participants explained how they understood the terms ‘special’ and ‘same’. Finally, participants completed a ‘Religiosity Scale’ (8-items; Rohrbaugh and Jessor (1975), and a novel scale assessing their ‘History of religious and ritual exposure’ (16-items; (Kapitány & Nielsen, 2015).

Materials. Following (Kapitány & Nielsen, 2015), half of the videos used in this experiment featured novel ritualized action sequences (causally opaque, goal demoted actions). The other half were matched sequences of ordinary actions (causally transparent, goal-apparent actions). There were three examples of each type of video in each category. All videos involved pouring a liquid from a small glass into a large glass, where superficial features of the procedure were varied according to condition. All videos are available upon request.

Both ritual and ordinary videos followed identical formats (see Figure 1). In which an experimenter presented a number of large glasses, performed a condition-specific

action on them, and poured an amber liquid from a smaller glass into the larger glass. The ritual condition included additional redundancy and concluded with the experimenter bowing to the glass (it was simply inspected in the ordinary condition). As per Kapitány and Nielsen (2015), videos belonged to one of three discrete blocks of stimuli. Block 1 involved one action performed on one of two glasses, Block 2 involved one action on one of three glasses, and Block 3 involved two actions on two of three glasses. In Block 3 one glass is singled out through inaction, while in Block 1 and 2, one glass was singled out by virtue of actions performed. Block 3 was included to ensure that participants' responses were attributable to qualities of the action, rather than the fact that one glass was singled out. The locations of the acted-upon object(s) in each block were fully counter-balanced (positions: Left, Right, or Centre). All videos were accompanied with the following statement: 'This video contains elements of established ritual seen around the world. The actions in this video can be seen in [ceremony name] of [Location]'. The ceremonies used were: 'Bwiti Ceremony (Gabon, Africa)', 'Kava Ceremony (Fiji, Pacific Islands), and 'Ayahuasca Ceremony (Ecuador, South America)'. Depending on goal condition, participants were either told that 1) These actions are a blessing. They are performed to give someone good luck and excellent health, 2) These actions a curse. They are performed to give someone bad luck and poor health, or 3) were provided no goal information.

Coding and Analysis. After each video the same questions were asked. When asked the forced-choice questions 'are the drinks the same' and 'is either/any drink special?', an affirmative response was coded as 1, with a negative response coded 0. Thus, a participant could score a maximum of 2 per block, where 2 affirms the quality on both trials, 1 indicates alternating responses, and a score of 0 represents no support for the quality. When asked to choose which drink they would select to drink, a score of 1 was awarded only if they selected a drink which had been acted-upon. Thus, 2 represents exclusive preference for the acted-upon object(s), 1 indicates alternating responses, and 0 indicates they consistently avoided the acted-upon drinks.

Such ordered categorical data is best treated with an Ordinal Logistic Regression

(OLR), but where the assumption of proportional odds was violated a Multinomial Logistic Regression (MLR) was used. Unless otherwise stated, all OLR analyses satisfied this assumption. For more information on OLR and MLR please see: Field (2013); Kleinbaum and Klein (2010); Menard (2010)

Are the drinks the same?. Using an OLR, neither Block 1 ($\chi^2(3) = 2.753, p = .431$) nor Block 2 ($\chi^2(3) = 1.305, p = .728$) had a better fit than the general model. A non-significant value indicates that a model with predictors is not better than a general model without predictors. The data in Block 3 returned a significant Test of Parallel lines ($p < .001$)³, but the final model fit was not significant, $\chi^2(3) = 1.279, p = .734$. Based on these null results we have no evidence to conclude that action-type or goal information influenced participants' perceptions of sameness amongst objects. Figure 2 shows the mean percentage of responses in each category with goal information collapsed into action-type.

Is either drink special?. In Block 1 we found a significantly better final model fit, $\chi^2(3) = 18.953, p < .001$, indicating that a model with predictors was better than a model without predictors. Pearson's Goodness-of-fit, $\chi^2(7) = 3.234, p = .863$, did not fall below the threshold for rejection ($p < .05$). As Table 1 shows, when actions are opaque, participants are 2.07 times more likely to report the presence of specialness at each [increasing] level of the DV. No effect of Goal was observed. Pseudo-R² values range from .021 (McFadden) to .045 (Nagelkerke).

In Block 2 we found a significantly better final model fit, $\chi^2(3) = 23.811, p < .001$. Pearson's Goodness-of-fit, $\chi^2(7) = 9.235, p = .236$, did not fall below the threshold

³This suggests that the assumption of proportional odds was violated. When an MLR was run (and the reference category was set 'drinks Always the same') the only significant result ($p = .037$) was that Opacity made participants about half as likely ($OR = .542$) to have alternating responses across presentations (but made no difference to reporting that objects different across both presentation). However, this analysis violated Pearson's Goodness of Fit statistic, $\chi^2(6) = 17.190, p = .009$. Inclusion of an interaction term (as discussed in 'Exploratory Analysis') returned no significant results. Thus, for the sake of consistency, and because no analysis appears superior to any other, the results of the OLR are reported here.

for rejection ($p < .05$). As Table 1 shows, when actions are opaque, participants are 2.28 times more likely to report the presence of specialness at each [increasing] level of the DV. No effect of Goal was observed. Pseudo- R^2 values range from .026 (McFadden) to .057 (Nagelkerke).

In Block 3 we found a significantly better final model fit, $\chi^2(3) = 28.919, p < .001$. Pearson's Goodness-of-fit, $\chi^2(7) = 9.027, p = .251$, did not fall below the threshold for rejection ($p < .05$). As Table 1 shows, when actions are opaque, participants are 2.58 times more likely to report the presence of specialness at each [increasing] level of the DV. No effect of Goal was observed. Pseudo- R^2 values range from .030 (McFadden) to .067 (Nagelkerke). Figure 3 shows the mean proportion of responses in each category with goal-information collapsed into action-type.

Thus, across all three blocks, when the modelled actions were opaque participants were more than twice as likely to report the presence of a special object within the set compared to causally transparent actions.

Which drink would you select to drink?. Blocks 1 and 3 on the 'drink' variable returned a significant result on the Test of Parallel Lines ($p < .05$), indicating that the logit (the odds ratio) varies between levels of the DV for a given IV. Block 2 had a Pearson's Goodness of fit violation. Thus, we used an MLR analysis.

In Block 1 we found a significantly better final model fit, $\chi^2(6) = 156.715, p < .001$. Pearson's Goodness-of-fit, $\chi^2(4) = 5.087, p = .279$, did not fall below the threshold for rejection ($p < .05$). As Table 2 shows, at level 1 of the DV, opacity does not significantly predict outcomes. However, at level 2 of the DV, opacity makes participants 2.96 times more likely the select the acted upon drink exclusively (i.e., to select it twice over two trials). Compared to no goal, a curse makes participants .44 times as likely to select the acted upon object once (at Level 1), and .08 times as likely to select the acted upon object exclusively (at Level 2). A blessing makes participants 1.95 times more likely to select the acted upon object once (at Level 1), and 1.98 times as likely to select the acted upon object exclusively (at Level 2). Pseudo- R^2 values range from .152 (McFadden) to .314 (Nagelkerke).

Table 1

Parameter estimates of ordinal logistic regression for ‘special’ scores for all three blocks of stimuli

Predictor	Wald’s χ^2	<i>p</i>	95%CI	Odds Ratio
<i>Block 1: Two Glasses One Action</i>				
Opacity (1) vs Transparency (2)	16.147	< .001	0.373 - 1.085	2.073
Curse (1) vs No Goal (3)	1.329	0.249	-0.174 - 0.671	-
Bless (2) vs No Goal (3)	1.613	0.204	-0.153 - 0.718	-
<i>Block 2: Three Glasses One Action</i>				
Opacity (1) vs Transparency (2)	20.373	< .001	0.466 - 1.182	2.280
Curse (1) vs No Goal (3)	0.245	0.620	-0.315 - 0.528	-
Bless (2) vs No Goal (3)	2.021	0.155	-0.121 - 0.761	-
<i>Block 3: Three Glasses Two Actions</i>				
Opacity (1) vs Transparency (2)	28.183	< .001	0.598 - 1.298	2.581
Curse (1) vs No Goal (3)	0.031	0.860	-0.378 - 0.454	-
Bless (2) vs No Goal (3)	0.072	0.789	-0.485 - 0.368	-

In Block 2 we found a significantly better final model fit, $\chi^2(6) = 114.913, p < .001$. Pearson’s Goodness-of-fit, $\chi^2(4) = 9.094, p = .059$, did not fall below the threshold for rejection ($p < .05$). As Table 2 shows, opacity does not significantly predict outcomes at Level 1. However, it does make participants 2.78 times more likely to select the acted upon object exclusively at Level 2. Compared to no goal, a curse makes participants .50 times as likely to select the acted upon object once (at Level 1), and .18 times as likely to select the acted upon object exclusively (at Level 2). A blessing makes participants 2.39 times as likely to select the acted upon object once (at Level 1), and 2.25 times as likely to select the acted upon object exclusively (at Level 2). Pseudo- R^2 values range from .112 (McFadden) to .240 (Nagelkerke).

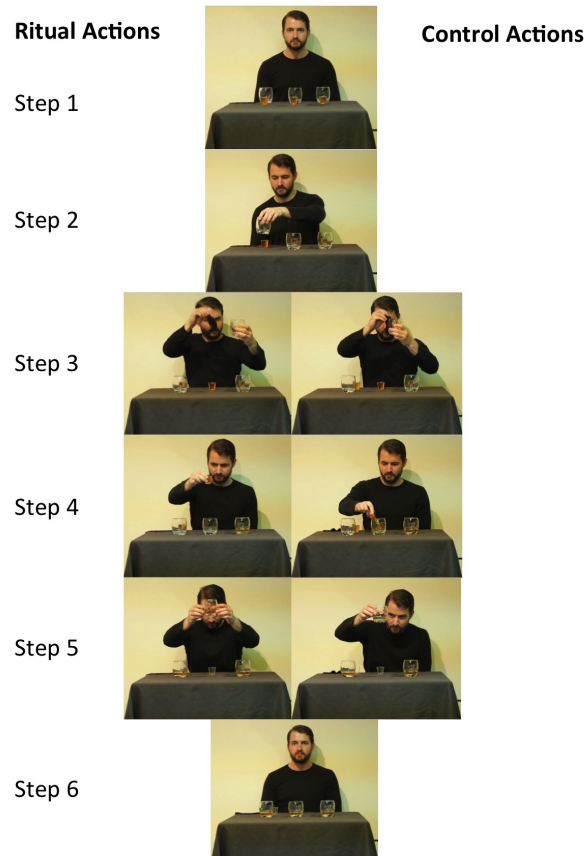
In Block 3 we found a significantly better final model fit, $\chi^2(6) = 49.685, p < .001$. Pearson’s Goodness-of-fit, $\chi^2(4) = 14.129, p = .007$, did fall below the threshold ($p <$

.05), which suggests there are non-linearities in the data, and the model fit could be improved by their inclusion (Field, 2013) a point discussed in the next section ‘Exploratory Analysis’. As Table 2 shows, opacity does not significantly predict outcomes at Level 1. However, it does make participants 1.78 times more likely to select the acted upon drink exclusively at Level 2.

Compared to no goal, a curse makes participants .49 times as likely to select the acted upon object once (Level 1), and .24 times as likely to select the acted upon object exclusively (Level 2). A blessing does not significantly predict responses at Level 1 or Level 2. Pseudo- R^2 values range from .048 (McFadden) to .110 (Nagelkerke).

In sum, across blocks, opacity increased likelihood of selecting an acted-upon object exclusively. Curses reliably decrease the likelihood of selection across both levels of the DV, and blessings generally increased the likelihood of selection.

Figure 1. Steps in Ritual and Control Sequences



The 6 illustrated steps demonstrate the similarities between the ritual and control actions (images show the ‘Cloth’ ritual acted upon the center glass). For both the ritual and control conditions steps 1 and 2 are identical, wherein the action begins and the demonstrator moves the smaller glasses in front of the larger glasses. In ritual Step 3 the cloth is waved vigorously at the glass, while in the control condition the cloth is used to clean the glass. In ritual step 4 the smaller glass is raised high before being poured into the larger glass, whereas in the control condition the smaller glass is poured directly. In ritual step 5 the glass is raised with both hands and bowed to, whereas in the control condition it is raised with one hand and inspected. Step 6 (for both conditions) shows the demonstrator returning to a neutral position.

Figure 2. Mean percentage of values on ‘same’ variables across all three blocks with goal information collapsed into action type.

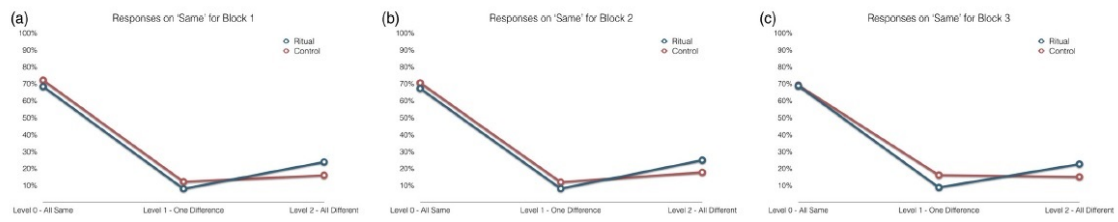


Figure 3. Mean percentage values on ‘special’ responses in each category with goal information collapsed into action type.

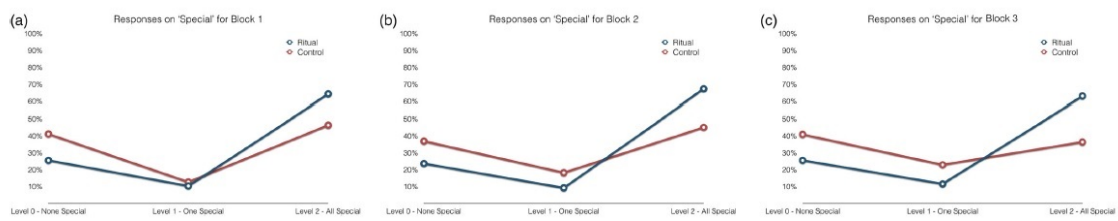


Table 2

Parameter estimates of ordinal logistic regression for 'drink' scores for all three blocks of stimuli

	Predictor	Wald's χ^2	<i>p</i>	95%CI	Odds Ratio
<i>Block 1: Two Glasses One Action</i>					
Picked Acted-Upon Object Once	Opacity (1) vs Transparency (2)	0.088	0.767	0.562 - 1.530	-
	Curse (1) vs No Goal (3)	8.406	0.005	0.246 - 0.774	0.436
	Bless (2) vs No Goal (3)	3.850	0.050	1.001 - 3.819	1.954
Picked Acted-Upon Object Twice	Opacity (1) vs Transparency (2)	19.402	< .001	1.827 - 4.803	2.962
	Curse (1) vs No Goal (3)	59.285	< .001	0.041 - 0.151	0.079
	Bless (2) vs No Goal (3)	5.405	0.020	1.114 - 3.537	1.984
<i>Block 2: Three Glasses One Action</i>					
Picked Acted-Upon Object Once	Opacity (1) vs Transparency (2)	0.007	0.933	0.591 - 1.620	-
	Curse (1) vs No Goal (3)	5.557	0.018	0.276 - 0.888	0.495
	Bless (2) vs No Goal (3)	6.727	0.009	1.237 - 4.614	2.389
Picked Acted-Upon Object Twice	Opacity (1) vs Transparency (2)	19.192	< .001	1.759 - 4.392	2.779
	Curse (1) vs No Goal (3)	36.766	< .001	0.103 - 0.312	0.179
	Bless (2) vs No Goal (3)	7.869	0.005	2.250 - 1.277	2.250
<i>Block 3: Three Glasses Two Actions</i>					
Picked Acted-Upon Object Once	Opacity (1) vs Transparency (2)	3.520	0.061	0.426 - 1.019	-
	Curse (1) vs No Goal (3)	7.049	0.008	0.297 - 0.833	0.497
	Bless (2) vs No Goal (3)	0.016	0.900	0.600 - 1.788	-
Picked Acted-Upon Object Twice	Opacity (1) vs Transparency (2)	5.800	0.016	1.113 - 2.843	1.779
	Curse (1) vs No Goal (3)	23.303	< .001	0.131 - 0.424	0.236
	Bless (2) vs No Goal (3)	0.106	0.745	0.534 - 1.566	-

Exploratory Analysis. An informed, post-hoc, decision was made to evaluate whether or not there was a significant interaction between Action-Type and Goal, as suggested by the Pearson's goodness-of-fit statistic on the desirability measure. All analyses were re-run including an interaction term. Using an OLR, the pattern of results remained identical for 'same' and 'special' and no interaction was observed (as one would expect, given the pattern of results in the a priori analyses). Using an MLR, a significant interaction between Action-Type and Goal was observed in drink preferences (as implied by the Pearson goodness-of-fit statistic), and the pattern of results remained largely intact (i.e., opacity had a significant and positive impact at level 2 across all three blocks). However, the influence of Goal Information varied. Due to the difficulty in describing interactions of nominal categorical IVs on ordinal categorical DVs with respect to a reference category we ran two separate analyses. First, we manually split our data by Action-Type, then ran an OLR to determine the influence of Goal on drink preference for those who observed ordinary actions, and a separate OLR on drink preference for those who observed ritualized actions. The results of these analyses (including tests of assumptions) can be seen in Table 3. For ordinary actions, in Block 1 and 2 we found that Goal information influenced drink preference in the expected directions at similar magnitudes as before. In Block 3, no effect of goal information was observed, indeed, the model fit was not significant. For opaque actions, curses made participants significantly less likely to select acted-upon objects at each level across all three blocks. Interestingly, blessings had no effect on participants' responses in any block. While both positive and negative goal information appears to influence participant perceptions for transparent actions, only negative goal information influences perceptions of opaque actions.

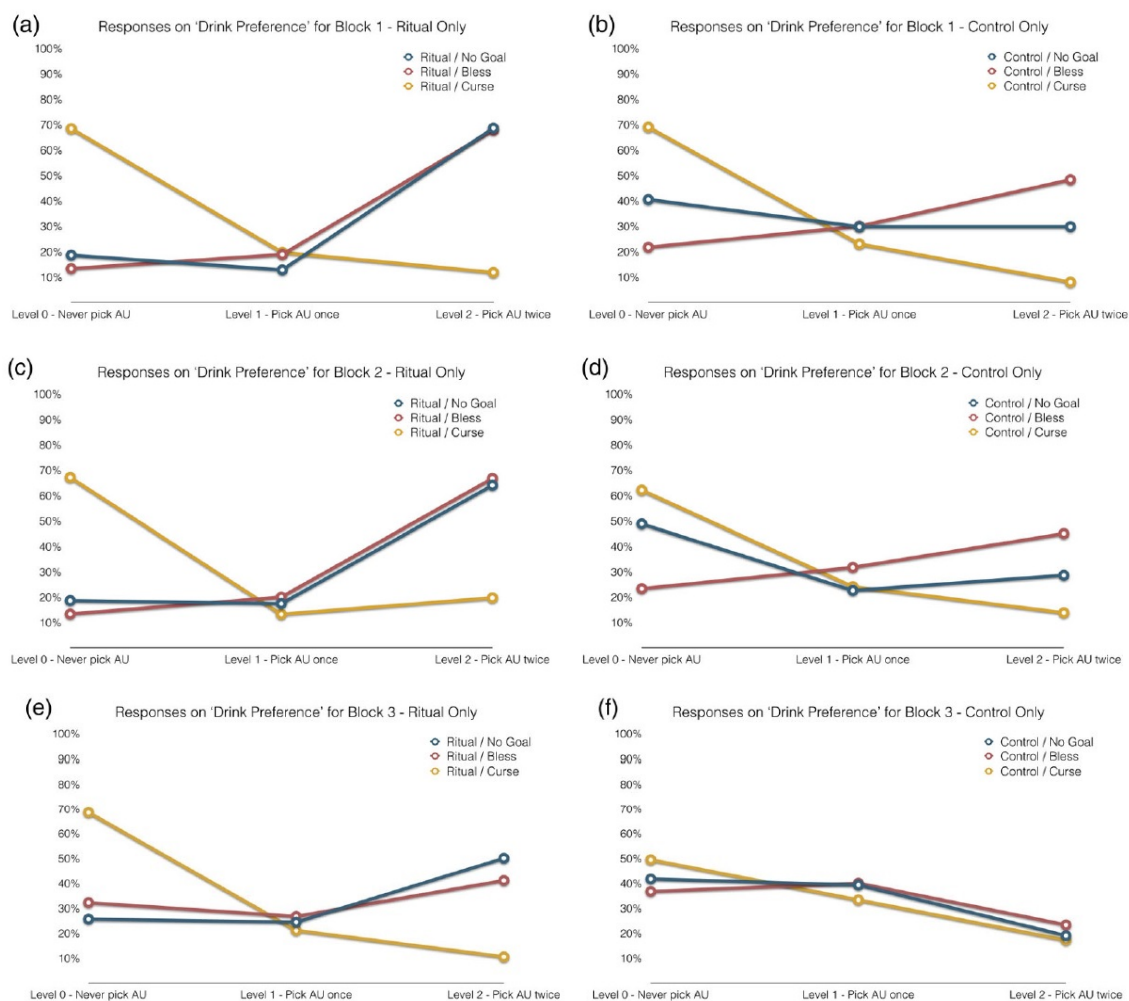
All analysis (see table 3) satisfied the assumption of proportional odds, and model fitness (except for the effect of goal information on transparent actions in Block 3, ($\chi^2(2) = 2.404, p = .301$).

Table 3

Statistics for Exploratory Analysis for all Blocks with data split by action type

	Predictor	Wald's χ^2	<i>p</i>	95%CI	Odds Ratio
Block 1					
Opaque/Ritual	Curse (1) vs No Goal (3)	53.592	< .001	-3.204 - -1.851	0.080
	Bless (2) vs No Goal (3)	0.020	0.888	-0.576 - 0.665	-
Transparent/Ordinary	Curse (1) vs No Goal (3)	16.841	< .001	-1.873 - -0.662	0.282
	Bless (2) vs No Goal (3)	7.294	0.007	0.236 - 1.482	2.361
Block 2					
Opaque/Ritual	Curse (1) vs No Goal (3)	42.279	< .001	-2.805 - -1.506	0.116
	Bless (2) vs No Goal (3)	0.299	0.585	-0.440 - 0.780	-
Transparent/Ordinary	Curse (1) vs No Goal (3)	4.788	0.029	-1.235 - -0.068	0.521
	Bless (2) vs No Goal (3)	8.570	0.003	-0.308 - 1.556	2.540
Block 3					
Opaque/Ritual	Curse (1) vs No Goal (3)	35.026	< .001	-2.559 - -1.286	0.146
	Bless (2) vs No Goal (3)	1.560	0.212	-0.903 - 0.200	-
Transparent/Ordinary	Curse (1) vs No Goal (3)	0.815	0.367	-0.824 - 0.304	-
	Bless (2) vs No Goal (3)	0.502	0.478	-0.393 - 0.838	-

Figure 4. Percentage responses for each category split by action type



Understanding participant responses on 'specialness' and 'sameness'.

After the videos, but prior to the survey items, participants were asked “After you watched the videos we asked you whether you thought objects were ‘special’ [‘the same’]...” and were respectively presented with each of the following sentences: “If you indicated that objects were special, in what way did you mean? How were you using the label ‘special?’” and “In what way did you understand the objects as being ‘same’ (or different)?”. Table 4 shows the coded qualitative responses with regard to their understanding of ‘same’ and Table 5 shows the coded qualitative responses for ‘special’.

The lead author developed a coding system based on the existing responses, and informed by previous work by Kapitány and Nielsen (2015) and predictions of the

action parsing system (Boyer & Liénard, 2006; Liénard & Boyer, 2006; Zacks et al., 2004). These responses were then coded in their entirety by two blind coders. special Responses had a mean percentage agreement 84.9% and a Krippendorff's Alpha of .767 (indicating 'Substantial' agreement; for context: values greater than .81 are regarded as 'Almost Perfect Agreement'. See Hayes and Krippendorff (2007). same responses had a mean percentage agreement of 89.64% and a Krippendorff's Alpha of .800.

When asked to define the term 'same', across all conditions, between 65.5% and 76.6% of all responses made reference to 'physical or visually accessible qualities of the object' (See Table 4 for full breakdown). When asked to define the term 'special' across all conditions, between 36.9% and 62.8% of all responses (forming the primary response category) made reference to the actor's actions or focus. We anticipated that this would happen proportionally more in ritual conditions, by virtue of the action's casual opacity. When analyzed with an MLR, we found a significantly better fit, $\chi^2(18) = 42.452, p = .001$. When the reference category was set to 'Denial of specialness' we found Opaque Actions made participants 2.136 times more likely to define special with reference to 'the actions or focus of the actor' (Wald Value(1) = 7.898, $p = .005$, $\beta = 0.759$, 95%CI = 1.258– 3.626). Opaque Actions also made participants 3.340 times more likely to reference a non-physical quality of the object (Wald Value(1) = 8.953, $p = .003$, $\beta = 1.206$, 95%CI = 1.516 – 7.359). Opaque actions also made participants 4.062 times more likely to refer to location of an object, (Wald Value(1) = 6.708, $p = .010$, $\beta = 1.402$, 95%CI = 1.406 – 11.734). There was no effect of goal information. Pseudo- R^2 values for 'special' ranged from .035 (McFadden) to .098 (Nagelkerke).

Table 4

Coded qualitative responses for 'same'

	Coded Response	Ritual/Curse	Ritual/No Goal	Ritual/Blessing	Ordinary/Curse	Ordinary/No Goal	Ordinary/Blessing
1	Denial of sameness	1 (1.3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
2	Reference to action/process or Attention/Focus of actor	13 (17.1%)	19 (22.1%)	16 (17.8%)	22 (25.3%)	13 (15.5%)	9 (15.0%)
3	Reference to physical or visually accessible quality of object	56 (73.7%)	58 (67.4%)	61 (67.8%)	57 (65.5%)	63 (75.0%)	46 (76.7%)
5	Reference to non-physical quality	3 (3.9%)	6 (7.0%)	3 (3.3%)	3 (3.4%)	5 (6.0%)	2 (3.3%)
6	Unintelligible response	3 (3.9%)	2 (2.3%)	10 (11.1%)	3 (3.4%)	5 (6.0%)	2 (3.3%)
7	Missing Data	0 (0%)	1 (1.2%)	0 (0%)	2 (2.3%)	1 (1.2%)	2 (3.3%)
	Total N	76	86	90	87	84	60

Table 5

Coded qualitative responses for 'special'

RITUAL COGNITION

	Coded Response	Ritual/Curse	Ritual/No Goal	Ritual/Blessing	Ordinary/Curse	Ordinary/No Goal	Ordinary/Blessing
0	Denial of specialness	10 (13.2%)	9 (10.5%)	10 (11.1%)	20 (23.0%)	19 (22.6%)	9 (15.0%)
1	References to Actions/Processes						
	Attention/Focus of the Actor	37 (48.7%)	54 (62.8%)	48 (53.3%)	37 (42.5%)	31 (36.9%)	36 (60.0%)
2	Reference to Physical or visually accessible qualities of object	6 (7.9%)	3 (3.5%)	2 (2.2%)	8 (9.2%)	12 (14.3%)	5 (8.3%)
3	Reference to non-physical qualities	9 (11.8%)	9 (10.5%)	12 (13.3%)	4 (4.6%)	8 (9.5%)	2 (3.3%)
4	Referred to acted-upon and/or non-acted-upon object	7 (9.2%)	2 (2.3%)	6 (6.7%)	3 (3.3%)	1 (1.2%)	2 (3.3%)
5	Reference to semantic information or re-iteration of statement	2 (2.6%)	0 (0%)	1 (1.1%)	1 (1.1%)	0 (0%)	0 (0%)
	Missing	4 (5.3%)	9 (10.5%)	8 (8.9%)	8 (9.2%)	7 (8.3%)	6 (10.0%)
	Total N	76	86	90	87	84	60

Participant Demographics. Participants completed a ‘Religiosity Scale’ (Rohrbaugh & Jessor, 1975), and a scale assessing their ‘History of religious and ritual exposure’ (Kapitány & Nielsen, 2015). Religiosity was measured on 3-sub-scales and aggregated into a single 5-point measure ($M = 2.24$; $SD = 1.29$; $\alpha = .95$) while history of religious and ritual exposure comprised 3 sub-scales (5-items on Superstitious Rituals, 8-items on Cultural Rituals, and 3-items on Religious Rituals). These scales were converted to a 6-points for aggregation ($M = 2.92$; $SD = .71$; $\alpha = .81$). Religiosity and Ritual exposure were moderately correlated at $r = .562$, $p < .01$. No systematic pattern correlation between these scales and the dependent variables was observed.

Discussion

In this work we aimed to dissociate the roles of goal demotion and causal opacity in adults’ processing of ritualized actions. First, neither action-type nor goal-information influenced participants’ perceptions of whether or not the objects were the ‘same’, with the vast majority interpreting sameness in terms of physical qualities of the object. Opaque actions reliably caused attributions of specialness, while goal-information had no effect. Indeed, the majority of participants organically defined specialness with reference to the actions or focus of the actor. Further, opaque actions made participants much more likely to exclusively prefer acted-upon objects. Such actions did not influence preference on only one trial, suggesting (for some people) ritualized actions provide a categorical imperative to select ritualized objects always. Critically, curses made objects less desirable: any action labelled a curse considerably increased avoidance. This is consistent with other work, in which people tend to be cautious of things that are ‘magically dangerous’ (Subbotsky & Quinteros, 2002) or essentially corrupted (Nemeroff & Rozin, 1994; Rohrbaugh & Jessor, 1975; Rozin, Millman, & Nemeroff, 1986; Savani, Kumar, Naidu, & Dweck, 2011). However, calling an action a blessing increased preference for acted-upon objects in Block 1 and 2, but not in Block 3. Follow-up analysis revealed an interaction (explaining this anomaly). We found that goal-information systematically varied preference across action-type.

Objects subjected to ordinary actions became less desirable when called a curse, but more desirable if called a blessing. Objects subjected to ritualistic actions became less desirable when called a curse, but were not influenced when called a blessing. As far as ritualized actions are interpreted positively by default (Kapitány & Nielsen, 2015) adding additional positive goal information appears to have little effect. *Actions*, so the saying goes, *speak louder than words*⁴. This suggests an interesting dissociation between causal opacity and goal demotion. Opacity informs our understanding of an object's status, while goal-information and opacity inform our approach/avoid behaviour toward such objects. Moreover, while negative goal-information causes aversion, positive goal-information does not always cause approach behaviour above-and-beyond variance attributable to opacity.

Other researchers have produced equally interesting work on this dissociation, modelling potential differences in action parsing attributable to these qualities (Nielbo & Sørensen, 2015; Sørensen & Nielbo, 2013). They report that 'cultural priors' tend to increase the degree to which cultural experts (those experienced and expert in a given ritual tradition, for example, a priest) see a ritualized act as ordinary and instrumental compared to one who is not a cultural expert. Thus, it is possible that actions are not necessarily treated equally in the minds of all individuals. Our ritual condition included a number of causally opaque and goal demoted actions, but also included bowing – a highly familiar, abstract action that carries pre-existing culture-dependent associations of respect and reverence. Any individual familiar, or 'expert', in the role a bow serves may rely heavily (and perhaps exclusively) on this action at the expense of the novel

⁴It should be noted that the measure of effect size presented here, the Pseudo-R² value, 'should be treated with caution' (Field, 2013). While it can be regarded as somewhat analogous to R² in linear regression, many have argued the measure has issues. Thus, while the effect of specialness is small, it is reliably elicited by the described methods, as it is consistent with experiments 1 and 2 of (Kapitány & Nielsen, 2015). A p-curve analysis conducted prior to this experiment suggested the effect has evidentiary value. A p-curve analysis of these prior experiments and the present experiment affirms this result. This data can be extracted from the stated publications, or is available from the corresponding author upon request.

actions in determining an objects' significance. However, we do not think this is the case here. When participants were asked how they defined special, only six participants (of 484) made explicit reference to the bow. Of those 6, all made reference to the bow as one of multiple actions (e.g., 'He ... did something to the particular glass... i.e. hum at it or bow to it' and 'I took it to mean if it ['specialness'] was gestured to via the flapping or sound or bowing'), and the two responses which appeared to make the strongest case for bowing without referencing other actions explicitly still included other generalities associated with the novel actions (i.e., 'Objects were treated with respect, and bowed head as a offering' and 'more elaborate ritual, the bowing and offering'). Given that participants in the ritual conditions saw six bows (across six videos) and up to three different kinds of ritualized actions, and only six made reference to the bow, four of whom made explicit reference to other ritualized actions, we do not believe the bow was privileged above-and-beyond the other actions.

Differences in how the term 'special' was understood across conditions revealed different levels of action-parsing. Causally opaque actions caused parsing at the lowest level (gesture) and generated an appeal to the actor's inner state. This is consistent with empirical work (Nielbo & Sørensen, 2011; Zacks et al., 2004, 2007, 2001) and theoretical predictions (Boyer & Liénard, 2006; Liénard & Boyer, 2006). It is nevertheless worth noting that ritual videos were typically slightly longer than the control videos, and the ritual videos contained two extra event-boundaries not generated by causal opacity: the redundant raising prior to pouring action, and the use of two hands (rather than one hand) in the bow/inspection action at the end of the sequence. However, the extent to which these two additional boundaries contributed to the overall effect is likely to be relatively minor. Ritual actions, by their causally opaque nature, generate more additional boundaries than ordinary actions, and so, the difference in perceived event boundaries between the two conditions is already considerably weighted in favor of the ritual condition. Further, this falls fully under the umbrella of cognitive capture – these two additional boundaries further captured participants, which in turn, likely increased the motivation to restore behavioural understanding. Finally, we are not

making the claim that a specific number of subunits of action make a ritual special or efficacious (though this is an interesting question), we are simply making the argument that a greater number of subunits (generated by opacity and goal demotion) motivates participants to restore a behavioural explanation for the actions, which begets appeals to the actor's goals. We found evidence in support of this position. However, we are cautious, and maintain this is only modest evidence for the role of cognitive capture.

Ritualized actions activate cognitive systems outside the proper range causing participants to process actions at a lower-level, in turn, motivating a search for the actions' meaning to restore default behavioural parsing and understanding (Herrmann et al., 2013; Legare & Souza, 2012; Nielbo & Sørensen, 2011; Rossano, 2012; Schjødt & Sørensen, 2013; Zacks et al., 2004, 2007, 2001). Lacking a clear way to integrate this experience, we interpret these deliberate causally opaque actions as socially normative (Field, 2013; Herrmann et al., 2013; Legare & Souza, 2012). Boyer and Liénard have argued that cultural rituals are a special case of ritualized behaviour: Mis-activations of the hazard system are calibrated throughout childhood, and adult responses are constrained to a limited repertoire of learned behaviours. We suggest the dominant calibrated response is to interpret the actions as normative. Further, we believe the phenomenon of overimitation may be the mechanism of calibration. Overimitation occurs when children copy obviously causally-irrelevant actions within a larger sequence of adult-modeled behaviour: When children observe these redundant, repetitive, goal demoted, causally opaque acts they interpret them normatively and conventionally (Kenward, 2012). Additionally, they copy with high-fidelity (Horner & Whiten, 2005; Lyons, Damrosch, Lin, Macris, & Keil, 2011) and do so reliably across cultures (Nielsen, Mushin, et al., 2014; Nielsen & Tomaselli, 2010). It is possible our observations reflect this calibration – ritualized actions activate the precaution system which has been calibrated throughout development to respond in a normative manner (notably, adults are more likely to overimitate than children; McGuigan et al. (2011)). We believe over-imitation/calibration explains why providing positive goal information (a blessing) doesn't influence behaviour toward goal demoted acts.

We propose, as predicted by the hazard precaution system, that over the course of development we begin to understand many actions as socially normative, particularly causally opaque and goal demoted actions (via over-imitation). Further, as predicted by the action parsing system, ritualized actions are parsed differently from ordinary actions due to the absence of a plausible causal mechanism and the obscurity of the actor's goals; ritualized actions are necessarily interpreted at the level of gesture rather than [behaviour], resulting in 'cognitive capture'. Such capture occurs when the precaution system activates outside the 'proper range' of stimuli, motivating us to restore a [behavioural] understanding. Thus, lacking a clear schema for why an action is being performed, and due to calibration in childhood, we interpret these actions as socially normative, as described by the ritual stance. More work needs to be done delineating how this process operates, work well outside the scope of the present study. Though it is notable that each of the distinct approaches has been previously validated and empirically supported.

While rituals only emerged as a part of our behavioural repertoire in recent evolutionary history, their ubiquity suggests they serve an adaptive role. Rituals, as intentional motor acts, are unique: they disrupt our capacity to infer a causal mechanism, they deny us insight into an actor's inner-state, and they activate cognitive systems adapted to other purposes. Understanding each of these elements is complicated, but here we contribute to the growing body of evidence that illustrates the importance each element plays. Moreover, we have taken modest steps toward dissociating the influence of goal demotion from causal opacity, and have attempted to unify into a causal chain several fields of psychological enquiry. While there are several competing and complementary grand theories of ritual cognition (notably Whitehouse's Modes of Religiosity and Henrich's CREDS), we believe Boyer and Liénard hazard precaution theory, in conjunction with Legare's ritual stance, coupled with a understanding of the development of overimitation, provide a more comprehensive frame-work than do the alternatives. Indeed, together they make important predictions about the underlying developmental, cognitive and evolutionary mechanisms of ritual

cognition, and dissociate the specific roles individual qualities play in ritual. Moreover, they inform both why we participate in rituals, and how we respond when we observe them. Targeted research is needed to test this proposal. Such work will reveal the foundations, mechanisms, and consequences of ritual actions, and provide insight into a core feature of the human behavioural repertoire.

Chapter Three: Does the ritual stance apply to object-directed rituals? Considering behaviour, development, and culture

Preface

The purpose the present chapter was two-fold. Based on prior findings, we intended to examine when adult-like ritual cognition emerged in development. This was done in Australia (a WEIRD culture) and Vanuatu (a non-WEIRD culture). We did not find support for our hypotheses. Thus, the second purpose was to examine the behaviour of adults in a more ecological setting (than was examined in prior chapters). In so doing, we could determine whether our failure in the first instance was related to development, culture, or construct.

Abstract

In experiment 1 we presented children from Australia ($N = 93$) and Vanuatu ($N = 109$) causally opaque and goal demoted actions directed towards objects. Over two trials we examined a child's preference for objects after they observed either ritualized or ordinary actions performed toward one of two identical objects. When given the choice, children did not appear to prefer objects that had been subjected to ritualized actions more than objects subjected to ordinary (causally transparent) actions. In experiment two we extended the findings presented in prior chapters. We exposed 101 undergraduate psychology students (in the first presentation) to either ritualized or ordinary actions, then (in a second presentation) the same kind of action but with goal information (the action was to 'curse' or to 'bless'). Contrary to our predictions, ritualized objects did not lead to attributions of specialness, nor did they influence preference. While the effect of goal information did appear to influence preference, it appeared to be driven by positive goal information (i.e., 'blessings'), which was contra to predictions. Participants did report differing degrees of recall between ritualized and ordinary actions. These null results are discussed in the context of prior findings.

Introduction

Rituals permeate all societies. We use them to mark boundaries between childhood and adulthood, life and death, and the past and future. They delineate us and them, right and wrong, and the known and unknown. We may perform them as often as once a day, or as infrequently as once a generation. Rituals, it seems, are rich fodder for enquiry, potentially offering unique insights into human culture and human cognition. Over the last few decades, the study of ritual from a psychological perspective has primarily focused on questions related to groups and group membership: such as how they form, cohere, spread, and transmit values and identities (Bulbulia et al., 2013; Henrich, 2009; Konvalinka et al., 2011; Legare & Nielsen, 2015; Legare & Souza, 2014; Mitkidis et al., 2014; Reddish et al., 2014; Rossano, 2012; Soler, 2012; Sosis, 2000; Sosis & Bressler, 2003; Sosis et al., 2007; Wen et al., 2015; Whitehouse & Lanman, 2014; Wiltermuth & Heath, 2009). But rituals offer more than an insight into groups. Due to their ubiquity cross-culturally, the examination of rituals offers opportunity to answer interesting questions that relate to human development and evolution. Such as what features need to emerge in childhood to facilitate and motivate an adult-like understanding and adherence to ritual? And yet one line of enquiry in this field has not received sufficient attention, despite the fact it might very well be one of the most common forms of ritual expression: How do rituals directed towards objects influence our cognitions and behaviour.

Our everyday experience suggests we treat ritual objects differently: a birthday cake is not an ordinary dessert, communion wine is more like blood than liquor, and a wedding ring is not merely a gold band. Intuitively, we regard these objects as different from their counter-parts - and it seems reasonable to suggest that it is, in part, our ritual treatment of these objects that makes this so. And so we ask: *Does ritualized action change our perception of, and behaviour toward, objects, and if so, how?* In this chapter I present two experiments, closely modelled off prior research, that examine our behavioural responses toward objects subjected to ritualized action. Specifically, these experiments were designed to measure actual behaviour and to address questions of

cognitions associated with the perception of ritual. Further, we have also attempted to consider how this kind of behaviour manifests across the life-span as well as across cultures.

But before we attempt to understand how ritualized actions influence our perception of objects, we must consider what rituals are, and how we identify them as something different from *ordinary* action. To observe an ordinary action is to understand or infer the intentions of the actor performing the actions, and to recognize the causal contingencies that facilitate the desired outcome. To describe the form of a typical ‘ordinary action’ is, in effect, absurd. In what ways are typing on a keyboard, digging a hole, making coffee, having sex, or riding a bike similar? And yet, in each instance (perhaps contingent upon a little prior learning), we can easily infer the actor’s goals and intentions, and the methods by which they intend to bring about a desired end-state. Ritual actions deviate from this pattern in important ways, and as such it is possible to consider the form of a typical ritual (even if specific ritual forms might appear highly variable and uncategorizable). Rituals tend to share features of repetition, redundancy, formality, and stereotypy (Boyer & Liénard, 2006; Bulbulia & Sosis, 2011; Eilam et al., 2006; Kapitány & Nielsen, 2015, 2016; Legare & Souza, 2012; Rappaport, 1999; Rossano, 2012). Yet many ordinary actions feature these qualities also, and so this definition is clearly insufficient. Rituals also tend to prioritize correct performance of the process over production of the outcome (if a physical outcome is even evident). Similarly, many conventional actions also require these conditions to be met. Clapping one’s hands in applause, dancing, even tying a tie (Acerbi & Mesoudi, 2015), all require one to prioritize process over outcome. But the most pivotal distinction between ritualized forms and ordinary forms is that rituals tend to feature causal opacity and goal demotion (Boyer & Liénard, 2006; Fux et al., 2013; Legare & Souza, 2012; Legare, Wen, et al., 2015; Liénard & Boyer, 2006; Mitkidis et al., 2014; Nielbo & Sørensen, 2011, 2016; Nielsen, Kapitány, & Elkins, 2014; Rossano, 2012; Schjødt & Sørensen, 2013; Sørensen & Nielbo, 2013; Watson-Jones et al., 2014; Wen et al., 2015).

Causal opacity describes a quality of action in which an observer of an action has

little-to-no access to the mechanism by which the action causes an outcome (while causal transparency describes the ease with which a causal mechanism is identified). Goal demotion describes how the observation of an action affords little-to-no insight into the motive or intention of the actor. And while there are still some ordinary actions that feature causal opacity and goal demotion (particularly when there is no prior experience or learning), there are far fewer examples. And so we find (and will argue hereafter) that the conjunction of these motor features, procedural emphases, and task-and-mind reading qualities are what defines a ritual and ritualized behaviour. That is, *ritualized behaviour is typically causally opaque and goal demoted as a consequence of the repetition, redundancy, formality, and stereotypy of the motor features, and as a result we prioritize accurate performance of process over outcome.*

But how do we perceive ritualized action? Consider the following thought experiment, as described in the introduction of this dissertation:

Imagine the room attendant of an upmarket hotel. The attendant's job is to clean recently vacated rooms. In so doing, the task is typically performed while the following conditions are met: the attendant is wearing an immaculate and standardized uniform (formality), they perform their obligatory actions (rigidity) during a specific window of opportunity. The attendant most likely enters the first room, and follows a reproducible set of procedures (first clean the bed, then the bathroom, then the floors, then the windows; accurate performance of actions). This attendant, by virtue of the prestige of the hotel, likely performs all these actions whether or not they actually need to be performed. If one of the beds has not been used it will nonetheless be cleaned (redundancy). And, of course, the very act of cleaning itself is highly repetitive. And this procedure will be repeated many times a day, every day of the week. The point is that many kinds of ordinary actions, with perfectly instrumental explanations, embody many of the features of ritualized behaviours. And yet, by any understanding - either in the lay sense, or a scientific sense - to conclude that the attendant's actions were a part of a ritual would be absurd (or at the very least useless). However, if you were to observe a formally dressed person who, at a specific time, entered the woods and

appeared to - in specific order - douse, rub, and anoint the bark, branches and leaves of a tree, then to repeat these actions on another tree, and another... you would be at a loss to describe that person as doing anything other than performing a ritual!

This scenario helps demarcate the difference between ritualized actions from ordinary action, and articulates the difference as a matter of perception and cognition. We perceive actions according to *schemas* (Schmidt, 2003). Schemas are large over-arching frame-works of perception. One example (as above) might be ‘cleaning a hotel room’. Schemas are broadly informative, but lack specific information. For there are many actions that might contribute to cleaning a room, but no single action is sufficient alone to satisfy the schema. Ordinary actions that constitute a schema are categorized as *behaviours* (Zacks et al., 2007; Zacks & Tversky, 2001; Zacks et al., 2001). Behaviours are specific instances of action that constitute the schema, examples might include cleaning a mirror, vacuuming a carpet, or changing bedsheets. Each of these behaviours alone might be native to the schema, but a) alone do not constitute a schema, and b) their omission is not sufficient to violate or alter the schema. Each behaviour is made up of individual *gestures* (Zacks et al., 2007; Zacks & Tversky, 2001; Zacks et al., 2001). Gestures are explicit description of motor actions, and are (broadly) the lowest level of action-parsing. Consider what is required to clean a mirror: one must [hold a mist-bottle][squeeze the mist-bottle][hold a washcloth][wipe mist from mirror using cloth] etc,. The observation of action can be usefully broken into these levels of analysis, which appear to manifest slightly different between ordinary and ritual actions.

To return to the hotel attendant problem - there is no schema associated with the ritual part of the example. What does it mean to ‘Clean a forest’. Nor can we understand the actions described at a gestural level. Again, what does it mean to ‘clean a tree’? Because the actions are ritualistic - in that the redundancy, repetition, formality, and stereotypy obscure the intentions of the actor, as well as the mechanism of action (which in turn necessitates a focus on accurate performance rather than outcomes) - we are forced to parse what we observe as gestures. In this example, the cognitively accessible approach is to describe the attendant’s actions: they [hold a

mist-bottle][squeeze the mister on to a tree][hold a washcloth][wipe the mist/tree].

When we observe the actions of others', particularly actions that we have no prior experience with, we attend and cognitively prioritize the intentions and goals of the actor over other characteristics (Bekkering, Wohlschläger, & Gattis, 2000; Gleissner, Meltzoff, & Bekkering, 2000; Heider, 1958; Malle, Moses, & Baldwin, 2001) and actively construct an understanding of the actor's intention in real time (Wilder, 1978a, 1978b). Further, when the actions themselves violate our intuitive understanding of causation we find ourselves cognitively arrested (Boyer & Liénard, 2006; Liénard & Boyer, 2006). These features, in turn motivate us to restore our understanding of what we're seeing, from that of gesture, to that of behaviour (the default level of parsing) (Nielbo & Sørensen, 2015; Schjødt & Sørensen, 2013; Sørensen, 2007b; Zacks et al., 2007; Zacks & Tversky, 2001; Zacks et al., 2001). Thus, the perception of ritual action is qualitatively and quantitatively different: we perceive ritualized actions at the level of the constituent elements, all the while attempting to infer causal- and goal-related information (Kapitány & Nielsen, 2016; Wilder, 1978a, 1978b).

From a social point of view, this ability - identifying ritualized action as distinct from ordinary action - may be the product of an evolutionary imperative. Considerable evidence exists demonstrating that rituals are an inherently social phenomena: they may solve adaptive problems of group living, including identifying in-group members, facilitating co-operation, acquiring and transmitting cultural knowledge, detecting free-loaders, and signalling one's own commitment to a group and the group's values (Atran & Ginges, 2012; Atran & Henrich, 2010; Ensminger, 1997; Henrich, 2009; Irons, 2001; Legare & Nielsen, 2015; Reddish et al., 2014; Rossano, 2012; Ruffle & Sosis, 2007; Sosis & Bressler, 2003; Wiltermuth & Heath, 2009). Social groups, particularly groups under pressure to endure or perish, appear to survive longer as their rituals become more salient (as a function of 'cost') (Ruffle & Sosis, 2007; Sosis & Bressler, 2003; Sosis et al., 2007). Thus, it appears a necessary and fundamental human ability to perceive, understand, and respond to ritual acts. Any individual not capable of this is likely to be at a disadvantage compared to their peers, for rituals provide means for forming

important social relations, engendering trust, avoiding exploitation (Henrich, 2009) and cueing appropriate conventional responses.

Now that we've established how rituals are perceived (and that we may be fundamentally motivated to perceive them), the next task is to understand how this influences behaviour. The ritual stance is one theoretical approach to understanding and explaining behavioural and cognitive responses to rituals: when we observe ritualized actions - actions with causal opacity and goal demotion, featuring repetition, redundancy, formality, stereotypy, and so on - we interpret them as being socially informative and normative (Herrmann et al., 2013; Legare & Souza, 2012). And while this can be a particularly useful approach for understanding group-related behaviours, we are still left with the question we posed in the beginning: *how does ritualized action change our perception of objects?* Might the ritual stance make predictions in this domain?

There is evidence to suggest that, even outside the context of the group, we respond to rituals. Vohs et al. (2013) have shown that when individuals are asked to perform ritualized behaviour on ordinary foods people perceive the food as being more valuable and flavourful. Similarly, Kapitány and Nielsen (2015, 2016) have shown that the observation of ritualized behaviours toward objects increases perceptions of specialness of the objects, and prompts preferential responses towards those objects. According to Boyer and Liénard (2006); Liénard and Boyer (2006) observing ritualized actions (whether object-directed or not) may arouse a threat-response reaction, as the ritualized action is misidentified as an action indicative of inferred threat. Indeed, under some circumstances, when participants are instructed that the objects they are handling are 'bio-hazardous', they may unnecessarily increase the number of acts performed in the execution of a recipe-like procedure. While the topic of object-directed ritualized action is comparatively under-studied compared to group-relevant ritualized action, the existing evidence does suggest that ritualized actions do cue specific cognitive and behavioural responses. While the observation of ritualized performances need not necessarily demand a response of a *social* nature, it may nonetheless inform

subsequent cognition and behaviour. Is it the case that the ritual stance can also explain responses to object-directed rituals in the absence of typical cues associated with groups or conventionality? Might it be that ritualized behaviours are dictated by a hidden necessity, and maintained by a normative mechanism? Can the ritual stance predict how we respond towards ritualized objects, as well as does towards other kinds of behaviour?

Ritualized actions are recognized as such by virtue of a dissociation between causal relations and an obfuscation of actor's intentions. Such actions, while demonstrably social in nature, arrest our attention and motivate specific, positive attributions and responses (Legare, Whitehouse, et al., 2015). For this reason it is not enough to limit the investigation of ritual to social groups and social topics; rituals ought to influence our perception of objects. Thus, we have attempted to conceptually and behaviourally replicate the work of Kapitány and Nielsen (2015, 2016), in - first - a developmental and cross-cultural context, in which we attempt to identify when adult-like ritual cognition emerges, and whether or not it does so similarly cross-culturally, and - second - in an adult behavioural context in which we attempt to replicate prior findings, and more deeply examine questions of ritual cognition.

Experiment 1: Children across Cultures

Kapitány and Nielsen (2015, 2016) have shown that adults tend to perceive and respond to ritualistic action in a qualitatively different manner from that of ordinary action. While ritualistic and ordinary actions do not appear to have a differential influence on whether people think the actions cause a physical change to take place, it has been reported that ritualistic actions make people more likely to report that a non-physical change has taken place - that the objects become 'special' - and this, in turn, appears to make people desire the ritualized objects. And, as asserted in the introduction of this chapter, it seems a commonplace occurrence that adults treat objects subjected to rituals different from identical profane counterparts. The question posed herein, then, is *when do children come to exhibit adult-like behaviours in response*

to rituals?

In examining this we attempted to address two specific problems. The first has already been stated (above). The second question has two parts, each of considerable importance, and are: *are our responses to rituals similar cross-culturally, and is the developmental trajectory similar also?* To address this we collected two age-matched convenience samples, one in a WEIRD culture, and one from a traditional/indigenous culture in Vanuatu. More details are given regarding these locations in the following section, but the traditional culture was chosen as it appears orthogonal to western culture. The group studied had minimal influence from WEIRD cultures, and, if we find results consistent with our hypothesis, we can argue that aspects of ritual cognition may be dissociable from culture.

We modified and simplified both the stimuli and design employed by Kapitány and Nielsen (2015, 2016) so that it was appropriate for children and relatively language-free (so that it could be conducted outside of an English language environment). Rather than using three different kinds of stimuli (gesture, cloth, and hum) we employed only two (gesture and cloth; the hum was omitted as we could not confidently say, prior to testing, whether or not it held any specific meaning within the non-WEIRD culture). While the methodology is described in more detail in the appropriate section, in order to introduce the hypotheses, a brief outline is provided. Children observed the experimenter performing either a ritualistic or an ordinary action on one of two bowls (the bowls contained identical rewards). Children were then given the opportunity to select a reward from one of the bowls. This process was repeated a second time. Using a logistic regression we predicted that there would be a main-effect of condition, such that children would be more likely to select the focal bowl in the ritual condition compared to the ordinary condition. And that there would be a main effect of age, which would be driven by a significant interaction - older children are more likely to respond to ritualised action in an adult-like way than in the control action. Given that the traditional culture of Ni-Van is more ritualistic than is typically observed in WEIRD cultures (Rybanska, McKay, Jong, & Whitehouse, 2017), we anticipated that

Ni-Van children may be more sensitive (responsive) to object-directed ritualistic actions.

Participants and location. Children were recruited in three locations.

Brisbane

The first location was in Brisbane, Australia. Brisbane is a large, developed city, with compulsory free education (for children aged 5 years and older) and a predominantly English speaking population. Testing was conducted in Brisbane's 'Sciencentre', a large, public science museum located very near the central business district. We recruited a convenience sample of 93 children aged between 2 - 13 years who were entering/leaving the Sciencentre (mean age = 6.03 years, SD = 2.07 years).

Vanuatu: Ikunala and Yakel

The second and third locations were on the island of Tanna in Vanuatu. Specifically, we tested children in the 'Kastom' (traditional) villages of Ikunala and Yakel, where indigenous Melanesians live their lives according to Kastom (a traditional set of beliefs and practices). Ikunala is located inland from the coastal village of Lanakel, and children/families from other Kastom villages along the same mountain ridge as Ikunala travelled to participate in our research. We did not observe any children speaking English (though a few adults spoke rudimentary English, and a great number spoke Bislama - an English creole and one of the official languages of Vanuatu). Children in Ikunala do not have any kind of formal education. Unlike Yakel, Ikunala does not typically allow visitors into their villages without a clear purpose, and it does not generate any revenue from allowing tourists or outsiders (such as film crews) to visit. Residents of Ikunala retain a very traditional way of life, and Western influence is minimal. We provided Ikunala with gifts of food (e.g., coconuts, canned fish) and Kava in exchange for their participation.

Yakel is a Kastom village unrelated to Ikunala, located further south. Similar to Ikunala, children do not routinely receive formal education, and – to the best of our knowledge – do not speak English. The primary difference between these locations is that Yakel is more widely known, and is more accepting of visitors in exchange for gifts and – specifically - money. The language spoken in Yakel is distinct from that spoken in

Ikunala. The ages of all children (at both locations; $N = 109$) ranged between 3 - 9 years (mean age = 6.13 years, $SD = 2.00$ years).

Methods and Procedure. The present experiment was a simple between-subjects design, in which children observed an experimenter acting upon one of two bowls, each containing an identical small reward (a sticker). The actions were either ritualistic (causally opaque and goal demoted) or ordinary in nature. Two actions were adapted for use with children based on prior work (Kapitány & Nielsen, 2015, 2016). One action employed a cloth: in the ordinary condition the cloth was used to clean the bowl, while in the ritualistic condition the cloth was waved toward the bowl without making contact. The alternate action involved only the researcher's hand: in the ordinary condition the researcher picked up the bowl and cleaned/rubbed/scratched at it with his fingers as if moving grit or a stain. In the ritualistic condition, the hands and fingers were moved in a similar manner, slightly exaggerated, and in such a way that the action did not make contact with the bowl. In this way, the ritualistic actions were goal demoted (the intention of the actor was unclear) and causally opaque (how the actions brought about a specific effect was not apparent). The ordinary actions had similar qualities, but were causally transparent and goal apparent. All actions were performed toward a bowl for several seconds, before the bowl was given a half turn, and the actions repeated on an alternate face.

In Brisbane, families with children were approached and invited to participate in the research. Children sat at a table across from the experimenter. The experimenter then showed the child two identical stickers, and placed one into each of two bowls in front of the child. According to condition, the experimenter performed an action toward one of the bowls and told the child that they could have whichever sticker they wanted. Both the action [cloth/hand], and bowl location [left/right] were randomized on the first trial, and reversed on the second (such that a child did not see the same action twice, nor were the actions performed on a bowl at the same location twice). After the child chose, the bowls were stacked and the remaining sticker was removed. The process was then repeated. At the point of choice, the experimenter withdrew somewhat from the

interaction to avoid influencing the child's choice through gaze or gesture. After the process was complete children were then asked their age and date of birth.

The process in Vanuatu was identical, except we employed translators to ensure children understood the task and all age appropriate children in the village participated (consent was voluntarily provided by mothers and elders). Translators said to the child in the appropriate language "Look at the man, he's got two stickers. He's going to do some actions, then you can choose one of the stickers to have". After the actions were performed the experimenter said "you can choose whichever sticker you like". Translators were trained so that they never indicated to the child to choose a specific bowl, either through gaze, gesture, or words. Instructions were back-translated into English to the lead author's satisfaction.

In all locations, across both trials, a child was awarded a single point if they selected the acted-upon bowl. Thus, a child who selected the acted-upon object on both trials could score a maximum of two points, while a child who picked the alternative, would receive 0 points.

Results

Using a logistic regression we predicted that there would be a main-effect of condition, such that children would be more likely to select the focal bowl in the ritual condition compared to the ordinary condition. And that there would be a main effect of age, which would be driven by a significant interaction - older children are more likely to respond to ritualised action in an adult-like way than in the control action. We made no prediction regarding cultural differences, though this was to be tested nonetheless.

Using a multinomial logistic regression (MLR) in which Condition (Ritual, Instrumental), Cultural Background (Brisbane, Vanuatu), Age, and a Condition*Age interaction were entered, we did not find a significant model fit, $\chi^2(8) = 14.407, p = .072$, with a Pearson's goodness-of-fit statistic that did not fall below the .05 rejection threshold, $\chi^2(56) = 45.568, p = .791$. Table 1 shows the full pattern of results.

Table 1

Results of a logistic regression on object preferences.

behaviour		β	Wald	df	p	Exp(B)	Lower CI	Upper CI
Always Avoid	Ordinary Action	0.919	0.648	1	0.421	2.506	0.268	23.458
	Ritual Action	-	-	-	-	-	-	-
	Age	0.173	1.752	1	0.186	1.189	0.920	1.536
	Condition * Age	-0.097	0.294	1	0.588	0.907	0.638	1.290
	Vanuatu	-0.049	0.018	1	0.893	0.953	0.470	1.932
	Australia	-	-	-	-	-	-	-
Single preference	Ordinary Action	0.553	0.231	1	0.630	1.738	0.183	16.534
	Ritual Action	-	-	-	-	-	-	-
	Age	0.157	1.425	1	0.233	1.170	0.904	1.513
	Condition * Age	-0.066	0.130	1	0.718	0.937	0.656	1.337
	Vanuatu	-1.028	8.245	1	0.004*	0.358	0.177	0.722
	Australia	-	-	-	-	-	-	-

Note: The reference category is 'Always Prefer'.

We did observe, unexpectedly, that Ni-Van children (compared to Australian children) appeared .358 times as likely to select the focal object once relative to twice. To investigate this in an exploratory manner we conducted the same analyses but this time we coded whether or not a child changed their preference - for example, a child who did not change their preference chose the focal object on both occasions, while a child who did change selected, for example, the focal object in the first presentation but the alternative in the second. A multinomial logistic regression (MLR) in which Condition (Ritual, Instrumental), Cultural Background (Brisbane, Vanuatu), Age, and a Condition*Age interaction were entered, we found a significant model fit, $\chi^2(4) = 12.453, p = .014$, with a Pearson's goodness-of-fit statistic that did not fall below the .05 rejection threshold, $\chi^2(28) = 18.933, p = .900$. The Psuedo-R2 values suggested the model explained between 5.0 % (McFadden) and 8.5% (Nagelkerke) of the

variance. Ni-van children, compared to Australian children, were 2.905 times more likely change their preference between presentation. Table 2 shows the full pattern of results.

Table 2

Results of a logistic regression on preference switching.

Behaviour		β	Wald	df	p	Exp(B)	Lower CI	Upper CI
Changed preference	Ordinary Action	-0.209	0.043	1	0.837	0.812	0.112	5.895
	Ritual Action	-	-	-	-	-	-	-
	Age	-0.075	0.446	1	0.504	0.928	0.745	1.155
	Condition * Age	0.037	0.056	1	0.813	1.038	0.764	1.410
	Vanuatu	1.066	11.459	1	0.001*	2.905	1.567	5.387
	Australia	-	-	-	-	-	-	-

Note: The reference category is 'Did not change preference'.

Discussion. We predicted that children, like adults, would be more likely to prefer objects subjected to ritualistic actions over alternatives, compared to children who were able to choose between an object subjected to an ordinary action and alternatives. We did not find support for this prediction. Similarly, we expected that older children would be more likely to conform to this pattern of results - by virtue of being more 'adult-like' than younger children. Again, we did not find support for this prediction. We also did not observe any differences between cultures.

So what might explain this pattern of results? It's possible that, despite our best efforts to conceptually match the stimuli with that of prior findings, we unwittingly made a change that dramatically changed the nature of participant responses. We do not think this is likely to be the case - the stimuli were built around an *a priori* definition of ritual, and we employed two different kinds of ritual-action in order to control for artefacts. If it is the case that some undescribed change altered the pattern of responses, it allows for two possible inferences. First, we can have little confidence in prior findings as they relate to ritualistic action; it is nearly as likely that an artefact was responsible for prior results as it is here. If such a small and undetectable change influences the results so dramatically, it's possible that the effect we intend to observe is

not nearly as robust as anticipated, nor as robust as implied by our everyday experience. This suggests that some other feature of ritual (perhaps employed previously) provides considerably more explanatory power than ritualized action (as conforms to the given definition). A second possible explanation is that the ages of our participants (in which the maximum age was 9 in Vanuatu and 14 in Australia) was below the threshold for adult-like ritual cognition. The sample in which this effect has previously been observed was considerably older and as such it may be possible that children up to the age tested simply do not show adult-like ritual cognition (inasmuch as their behaviour is a proxy for this).

We did find that Ni-van children would persevere with their initial decision at rates higher than Western children. While it appears to be the case that Western children are statistically choosing at random in both presentations, the Ni-van children choose at random in the first presentation (i.e., either the focal or alternative bowl) and repeat the very same decision in the second presentation. Given that the first presentation reveals no systematic sensitivity to ritualistic behaviour, we choose not to dwell on this finding. It may reflect some curious tendency for children on Tanna to persevere, or may simply be a statistical fluke.

Experiment 2: WEIRD Adults

The following experiment has multiple goals. Like the experiment before it, it measures behavioural responses. Inasmuch as it is possible that results among children may be attributable to them being too young to perform in an ‘adult-like’ manner, here we examine the behaviour of adults in order to determine the validity of this claim. Similarly, in examining the behaviour of adults, we are conducting a replication of the results in chapter one and two in a behavioural context.

In examining results previously presented I have produced a number of specific predictions. First, ritualized action is not likely to lead a viewer to believe a physical change has taken place. Second, ritualised actions ought to lead a viewer to attribute non-physical qualities to the object. And third, such actions ought to motivate specific

object-directed responses. These predictions have all been derived from the results obtained in chapters one and two.

All three studies previously described employed the same basic design: participants watched videos of a model standing before a table. On the table were a number of empty glasses. The model would present each glass by moving it forward on the table. Once all the glasses were presented, they would perform an action on one of the objects (while ensuring that at least one other identical object on the table was not interacted with at all). The actions were either ordinary (like cleaning the glass with a cloth, or rubbing it with their thumb as though removing dirt) or ritualistic (such as waving a cloth at the glass in a 'cleaning motion' without making contact, or circling the object with their thumb without making contact). Here, the ritualistic actions were causally opaque and goal demoted - the viewer was not able to determine how an effect was brought about, nor why the act was performed by the model in the first place. After such an action was performed the model would pour into each identical glass an equal measure of an amber liquid. Participants were tasked with reporting whether they thought any of the objects in the array were different from any others, whether any objects were special (and if so, which one), and which of the objects was theirs to drink from. In this between-participants design, it was found that neither ritualistic nor ordinary actions led participants to believe that acted-upon objects were physically different from non-acted-upon objects. They also found that objects subjected to ritualistic actions were often more than twice as likely than those subjected to ordinary actions to be considered 'special'. Finally, those same objects were similarly more likely to be selected by the participant to drink from. In effect, ritualistic actions (compared to ordinary actions) did not lead to physical differences, but did lead to non-physical attributions, and a corresponding behavioural response.

These results are attributable to the effect of causal opacity and goal demotion. But what of causal opacity and goal demotion specifically? In chapter one I held constant these features, while manipulating peripheral cues (i.e., the social context of the act). In chapter two I manipulated the goal related qualities of the actions by

explicitly describing the purpose of the actor, and the ostensible outcome being realized. Participants saw the exact same range of actions with the following text: (“...*know that the actions I’m performing here are a [Blessing/Curse] designed to give you [good/bad] luck and [good/bad] health*”). In this case, while the actions themselves were causally opaque, they were no longer goal demoted. Participants could not determine how a curse (for example) was brought about, but they were aware that the intention of the actor in performing those actions was *to curse*. Here they found, as before, that the objects were physically unchanged. They found that objects subject to ritualized action were considered to be more than twice as special as those subjected to ordinary actions, and yet the knowledge of the actor’s intention (to bless or curse) had no effect on attributed specialness. This suggests that the non-physical attributions made by the participants related to the causal opacity of the action, and not their knowledge of the action’s intended purpose. Finally, it was found, that to bless an object made participants around twice as likely to report that the object was theirs to drink, while a curse made an object around four or five times *less* desirable. As before, the effect of ritual action was replicated - but when the influence of goal information was more closely analyzed, it was revealed that blesses and curses influenced *ordinary* actions in expected ways, only curses had an impact of ritualized action (to bless an object with a ritualized action did not account for variance above-and-beyond the effect of the action alone!). This was interpreted as further support for the ritual stance: ritualized actions are interpreted socially, and are associated with implicit expectations about behaviour.

Finally, the present experiment is an attempt to extend findings presented in chapter two. Here we are asking how it is that we recognize a ritual when we see one. As stated earlier, many ordinary actions contain repetition and redundancy, formality and stereotypy. As used by Kapitány and Nielsen (2015, 2016), ritualized actions with these features were compared to ordinary and interpretable actions with these features - the inspection and cleaning of objects. If you observed someone cleaning a glass, you would not describe their actions as ‘he stroked a glass five times with a cloth to remove dirt’, you would simply say ‘he cleaned the glass’ (or perhaps ‘he cleaned the glass with

a cloth'). But those same actions, when performed at a remove, and without an obvious goal or causal process, would arouse a response of the kind 'he waved a rag up-and-down five times at the glass, not touching it'. Humans, when observing the actions of others, parse the action sequences they observe into meaningful units and sub-units of information (Newtson, 1973; Nielbo & Sørensen, 2011, 2015; Zacks et al., 2004; Zacks & Tversky, 2001; Zacks et al., 2001). The actions sequences are partitioned hierarchically into schemata based on perceptual and functional information, and this information is partitioned according to achieving a hierarchy of goals (Zacks et al., 2004; Zacks & Tversky, 2001; Zacks et al., 2001). When the actions do not afford an understanding of larger goals (as a function of causality or intention) they tend to be broken down into smaller, more discrete units, as we tend to demarcate action units around the largest discernable goal within the sequence (Zacks et al., 2004), particularly since we may be trying to actively construct an understanding of the actor's intention on the fly (Wilder, 1978a, 1978b). That is, when we see a ritual, our understanding of it is coloured by our capacity to understand the intentions of the actor, and the manner in which we partition the action into smaller, more frequent chunks.

In chapter two I presented some supporting evidence for this. When participants were asked what they understood 'special' to mean in the ritual condition, they most often appealed to processes and intentions (rather than denying specialness, appealing to physical properties of the objects, or appealing to an intangible quality of the object), and did so at higher rates than participants who observed ordinary actions (who themselves more frequently denied specialness, and who only appealed to intangible qualities at floor-rates, even when the intention of the actor was to bless or curse). Thus, I have argued that this is evidence that people are attempting to *make meaning* of ritualized actions (as one need not make an appeal if the intention is implicitly understood). In the present experiment this idea is extended, by attempting to quantify the number of action units perceived, to argue that ritualized actions are identified as such by virtue of the way in which they are encoded and recalled.

Thus, the present experiment is essentially a registered replication attempt of

Chapter one and two; of Kapitány and Nielsen (2015, 2016) - but rather than examining self-reported intentions online - herein we examine actual behaviour. Thus, the following hypotheses were registered with the Open Science Framework.

Pre-registration. This experiment was pre-registered with the Open Science Framework (osf.io). The methods described here are an expanded, more formal, version of those pre-registered. All hypotheses are derived from Kapitány and Nielsen (2015, 2016). Readers are invited to contrast these documents in the interest of transparency.

1. Neither ritual nor ordinary actions will influence participant's rating of 'sameness'.
2. Participants will regard objects subjected to ritualized actions as more special than objects subjected to ordinary actions across both presentations.
3. Participants in the Ritual condition will more often choose acted-upon objects than participants in the Ordinary condition.
4. In Presentation 2, across both action-type conditions, participants will be more likely to avoid acted-upon objects if they are 'cursed'.
5. In Presentation 2, the effect of describing an action as a blessing will only result in a higher likelihood of preference in the Ordinary condition (i.e., there will be an interaction between action-condition and goal-condition)
6. Participants in the Ritual condition will describe more action units in Presentation 1 and Presentation 2 than participants in the transparent condition.

Participants. A total of 101 undergraduates were invited to participate in exchange for course credit. The mean age of the participants was 20.30 years (SD = 4.66), of whom 65.4% were female. English was the native language of 77.2% of participants (verbal checks revealed all participants understood the task).

Methods and Procedure

Participants were randomly assigned to an action-type condition and a goal-type condition prior to arrival. Upon arrival participants were briefed that the experiment

was examining decision-making behaviour, and given the opportunity to ask any questions. They were informed that once the experiment commenced they would have to wait until the end of the experiment to ask any additional question. This was done so that the participants would not ask for input from the researcher when given the opportunity to make focal decisions. Participants were also shown three kinds of prizes (bottle-openers, pens, and USB drives). They were asked to select two of these kinds of prizes for use in the experiment, which, they were informed, would later be able to keep.

The experiment consisted of two presentations which each had an identical form. The first presentation manipulated only action-type the participant saw. The second presentation presented the same action-type (as in the first presentation), but manipulated the goal-type information.

In each presentation the model stood behind a table, and provided a verbal cue that the presentation was about to begin: *“This is the first presentation, please pay attention”*. He then laid out a set of three identical objects (this set consisted of identical instances of one of the two objects participants had earlier selected) on a small raised podium on the table. The objects were laid out evenly spaced perpendicular, and in full sight, of the participant (their location will later be referred to as ‘left, centre, and right’). The experimenter then selected one of the objects (determined randomly prior to experiment beginning), picked it up, and performed a condition-appropriate action. The object was then returned to its original position and orientation. After this the researcher said: *“Please come up and select one of the objects”*. He then averted eye contact (and did not look at any of the objects), placed his hands behind his back and took a small step away. Once the participant made their selection their choice was recorded, and the remaining two objects were cleared away. The protocol was repeated using the second set of identical objects, and here the verbal cue described the action as either a blessing or a curse. Neither the instance of action (cloth, hum, gesture), nor the position of the acted-upon object (left, centre, right), was the same in presentation two as presentation one. Participants were then ushered into a second room in which they completed a battery of computer-based surveys (detailed below).

Action-Types. *Cloth Action.* In the Ritual condition a small black cloth was waved up-and-down vigorously at the object; at no point did the cloth make contact with the object. The control action had the demonstrator vigorously clean the object with the same cloth using a matched up-and-down motion.

Gesture Action. In the Ritual condition the demonstrator closed his hand and pointed with his thumbs at the object while moving his hand along the object's length; at no point did the gesture make contact with the object. The matched control action had the demonstrator – using the same hand position – ‘scratch’ the object with his thumb as if removing grit.

Hum action. In the Ritual condition the demonstrator held the object at head-height and began to hum in a long, unwavering and sustained fashion for three seconds. In the control condition the demonstrator held the object similarly for three seconds, and made a shorter, more variable noise (as if inspecting or observing a curious aspect of the object).

Coding. The first dependent variable was which object the participant selected to keep (hereafter: ‘preference’). If a participant selected the acted-upon object they were given a score of 1, and if they selected either of the two non-acted-upon objects they were given a score of 0. The second measure was how many action-units participants perceived/remembered when prompted after both presentations. Participants were asked to write, ‘in as much detail as possible’, what they remembered in both presentations. This was coded in two ways. The first value was coded by counting the number of verbs the participant used which were attributed to the actor (e.g., he took, he waved, he cleaned, he placed, he asked). This value was a simple measure of the number of action-units recalled. The second value was only other elements which one might expect to vary in recollection or importance between individuals - typically adjectives or adverbs, but also references to quantity (e.g., he cleaned for 3 seconds, he waved the cloth 3 or 4 times), specificity (e.g., he picked up the object with his right hand), motion (e.g., he moved his hand in a clock-wise direction), and relative special position (e.g., he rubbed the object from the middle to

the top, he moved his hand near to the side of the object, he raised the object to eye level, he picked up the object on the right). These values will be referred to as ‘specifics’. These two values together represent the number of actions recalled, as well as the richness with which they are recalled. These values were coded in full by an independent blind research assistant, and agreement between the lead author and the assistant was very high (Presentation 1, Verbs: $\alpha = .915$; Specifics: $\alpha = .846$; Presentation 2, Verbs: $\alpha = .926$; Specifics: $\alpha = .803$).

Self-report Battery. Several surveys were completed by participants in order to understand what cognitive or experiential factors influence ritual cognition. These scales measured Religiosity (Rohrbaugh & Jessor, 1975), Paranormal Beliefs (Tobacyk, 2004), Rational and Intuitive thinking styles (Pacini & Epstein, 1999), History of Religious and Ritual Exposure (Kapitány & Nielsen, 2015), and a revised and expanded scale measuring Ontological Confusion (see Appendix A; Lindeman, Svedholm-Hakkinen, and Lipsanen (2015)).

Pre-registered Analyses

Unless otherwise stated, all analyses are consistent with the pre-registered hypotheses.

Sameness: We asked participants if the three objects in presentation one were the same (this presentation only manipulated action-type). We ran a logistic regression with action-type as a categorical IV. Our model was not significant, $\chi^2(1) = .014, p = .906$. For presentation two we ran a logistic regression and included both action-type and goal-information (Bless/Curse) as predictors, and we found that our model was significant, $\chi^2(2) = .9.923, p = .007$, explaining approximately 19.8% of the variance (Nagelkerke pseudo- R^2). The effect of action-type was significant, such that transparent actions made participants 11.439 times as likely to report the objects as being the same compared to ritual actions, Wald Value(1) = 5.037, $p = .025, \beta = 2.437, 95\%CI = 1.362 - 96.090$. There was no effect of goal-type on scores of sameness, Wald Value(1) = 2.337, $p = .126, 95\%CI = .074 - 1.381$. Because

Odds Ratios are unstandardized measures of effect size, table 3 shows the raw values in order to provide context.

Table 3

Raw values of agreement on the measure of ‘sameness’ in each presentation by condition.

Presentation 1	<i>Were all the objects the same?</i>	Yes	No	missing data
	Ritual Condition	48 (92.3%)	4 (7.7%)	0 (0.0%)
	Ordinary Condition	44 (89.8%)	4 (8.2%)	1 (2.0%)
Presentation 2	<i>Were all the objects the same?</i>	Yes	No	missing data
	Ritual Condition	43 (82.7%)	9 (17.3%)	0 (0.0%)
	Ordinary Condition	47 (96%)	1 (2.0%)	1 (2.0%)
	Bless Condition	38 (90.5%)	4 (9.5%)	0 (0.0%)
	Curse Condition	36 (83.7%)	7 (16.3%)	0 (0.0%)

Specialness: We asked participants if any of the three objects in Presentation 1 were special. We ran a logistic regression with action-type as a categorical IV. Our model was not significant, $\chi^2(1) = .140, p = .708$. For Presentation 2, we ran a logistic regression and included both action-type and goal as predictors, again, our model was not significant, $\chi^2(2) = .692, p = .707$. Table 4 shows proportional responses.

Preference in P1: We used a logistic regression to determine whether the action-type a participant observed in P1 influenced the object they selected. Our model was not significant, $\chi^2(1) = 2.571, p = .109$. In the Ordinary condition, 39 (79.6%) participants chose the alternative, while 10 (20.4%) chose the acted-upon object. In the Ritual condition, 34 (65.4%) chose the alternative, while 18 (34.6%) picked the acted-upon item.

Preference in P2: Using the same coding method as above, we conducted a logistic regression to see if the action-type a participant observed, the stated purpose of the action, and an interaction term, influenced participant’s preference. This model was significant, $\chi^2(3) = 14.397, p = .002$. The model explained approximately 17.8% of variance (Nagelkerke pseudo- R^2). Analyses revealed that the effect of action-type did

Table 4

Raw values of agreement on the measure of ‘specialness’ in each presentation by condition.

Presentation 1	<i>Were any of the objects special?</i>	Yes	No
	Ritual Condition	18 (43.9%)	22 (53.7%)
	Ordinary Condition	16 (36.4%)	28 (63.6%)
Presentation 2	<i>Were any of the objects special?</i>	Yes	No
	Ritual Condition	24 (58.5%)	17 (41.5%)
	Ordinary Condition	23 (52.3%)	21 (47.7%)
	Bless Condition	22 (52.4%)	20 (47.6%)
	Curse Condition	25 (58.1%)	18 (41.9%)

not significantly predict preference,

$WaldValue(1) = .045, p = .833, 95\%CI = .279 - 2.798.$

However, we found calling an action a blessing (compared to a curse) made participants 3.75 times more likely to select the acted upon object, $WaldValue(1) = 4.978, p = .026, \beta = 1.323, 95\%CI = 1.174 - 11.995.$ The interaction term was not significant, $WaldValue(1) = .315, p = .575, 95\%CI = .295 - 9.032.$ In the Ordinary condition, 29 (59.2%) chose the alternative, and 20 (40.8%) chose the target. In the Ritual condition, 28 (53.8%) chose the alternative, and 24 (46.2%) chose the target. Table 5 shows proportional responses.

The differential influence of an actor’s purpose across action-type: As per Kapitany and Nielsen (2016) we split the data by action-type, then ran a logistic regression on each dataset to determine whether goal-information had a differential impact. For participants in the Ordinary condition, we found our model was significant, $\chi^2(1) = 8.821, p = .003.$ The model explained approximately 22.2% of the variance (Nagelkerke pseudo- R^2). Participants who were told ordinary actions were a blessing were 6.13 times more likely to select the acted-upon object than participants who were told ordinary actions were a curse,

Table 5

Raw values of agreement on the measure of preference in each presentation by condition.

Presentation 1	<i>Did the participant select the focal object</i>	Yes	No
	Ritual Condition	18 (34.6%)	34 (65.4%)
	Ordinary Condition	10 (20.4%)	39 (79.6%)
	Bless Condition*	11 (26.2%)	31 (73.8%)
	Curse Condition*	10 (23.3%)	33 (76.7%)
Presentation 2	<i>Did the participant select the focal object</i>	Yes	No
	Ritual Condition	24 (46.2%)	28 (53.8%)
	Ordinary Condition	20 (40.8%)	29 (59.2%)
	Bless Condition	24 (57.1%)	18 (42.9%)
	Curse Condition	11 (25.9%)	32 (74.4%)

* *This condition information was not apparent to participants in the first presentation.*

It has been shown here for context.

$WaldValue(1) = 7.998, p = .005, \beta = 1.812, 95\%CI = 1.744 - 21.509$. For participants in the Ritual condition, we found our model was significant, $\chi^2(1) = 5.284, p = .022$, and explained approximately 12.9% of variance (Nagelkerke pseudo- R^2). Participants who were told ritualized actions were a blessing were 3.75 times more likely to select the acted-upon object than participants who were told ritual actions were a curse, $WaldValue(1) = 4.978, p = .026, \beta = 1.323, 95\%CI = 1.174 - 11.995$. Table 6 shows the proportional responses for context.

Keeping in mind that goal information was not relevant in presentation one, it is clearly the case that participants behaviour did not change as a consequence of the actions in presentation two being called a curse. Rather, the effect appears to be driven by calling the second presentation a blessing (see Table 6). Given the similarities between numbers over both presentations, a correlation was conducted between likelihood of selecting the acted-upon object in presentation one and presentation two. No correlation was found amongst the 42 participants in the bless condition ($r = .188, p$

Table 6

Proportion of individuals who selected the focal object in each presentation as a function of Goal-condition.

Presentation 1	Ritual Action	Ordinary Action
Bless Condition	7 (33.3%)	4 (19.0%)
Curse Condition	5 (25.0%)	5 (21.7%)
Presentation 2	Ritual Action	Ordinary Action
Bless Condition	11 (52.4%)	13 (61.9%)
Curse Condition	6 (30.0%)	5 (21.7%)

= .234), nor was there a correlation amongst the 42 participants in the curse condition ($r = .056$, $p = .723$).

Action sub-units: In Presentation 1 an independent samples t-test revealed a significant difference in the number of action sub-units (Verbs) recalled, $t(99) = 2.057$, $p = .042$, $95\%CI = -1.454 - -.026$, such that participants in the Ritual condition described more action units ($M = 4.577$, $SD = 2.042$) than did the Ordinary condition ($M = 3.837$, $SD = 1.519$). Similarly, on the measure of specificity (i.e., adjectives and adverbs), there was a significant difference, $t(93.650) = 3.132$, $p = .002$, $95\%CI = -1.720 - -.385^5$, such that the Ritual condition was recalled in more detail ($M = 2.81$, $SD = 1.93$) than the Ordinary condition ($M = 1.76$, $SD = 1.42$). In Presentation 2, we did not observe a significant difference in the number of recalled sub-units (Verbs) between the Ritual condition ($M = 4.529$, $SD = 2.352$) and the Ordinary condition ($M = 3.980$, $SD = 1.534$), $t(98) = 1.378$, $p = .171$, $95\%CI = -1.341 - .242$. Similarly, on the measure of specificity, we did not find a significant difference between the Ritual condition ($M = 2.25$, $SD = 2.09$) and the Ordinary condition ($M = 1.59$, $SD = 1.21$), $t(80.67) = 1.96$, $p = .054$, $95\%CI = -1.338 - .012$.

⁵Levene's Test for Equality of Variance returned a significant results ($p = .008$) and so the t-values presented assume variances were not equal.

Exploratory Analyses. The following analyses are exploratory, and were not pre-specified in the original registration.

Participants were asked to what extent they thought the object they selected in Presentation 1 had positive or negative properties on a 100 point scale, where 50 was ‘*the object is totally ordinary*’ and the end points were ‘*the object has negative(0)/positive(100) qualities*’. As evident in Tables 7 and 8, we observed no differences between conditions. Importantly, by comparing means, it is apparent participants did not think that the objects they selected varied in valence between blessings and curses, but also that they thought the actor had no more capacity to imbue the objects with these qualities than they did in Presentation 1.

As can be seen in Table 9, we found that paranormal beliefs were positively associated with increasingly positive evaluations of the objects selected, and that these beliefs were associated with a belief that the actor had some capacity to imbue objects with these qualities. We find a relationship that increased exposure to rituals predicted a belief that the actor could imbue objects with qualities. Scale items correlated in systematic ways, but did not appear to bear upon attributions of objects or the actor’s ability to imbue objects (see Table 7).

Table 7

Statistics Regarding object and actor attributions by action-type

		Condition	N	Mean	SD	t-test
Presentation 1	Pos / Neg properties of selected object	Ordinary	46	52.46	12.66	$t(96) = .682,$
		Ritual	52	42.06	7.20	$p = .497$
	Actor’s Influence	Ordinary	46	19.17	29.72	$t(95) = .993,$
		Ritual	51	13.65	25.10	$p = .323$
Presentation 2	Pos / Neg properties of selected object	Ordinary	47	39.87	26.70	$t(93) = 1.583,$
		Ritual	48	47.94	22.85	$p = .117$
	Actor’s Influence	Ordinary	45	18.27	30.58	$t(93) = .004,$
		Ritual	50	18.24	28.44	$p = .996$

Table 8

Statistics Regarding object and actor attributions by goal information

		Condition	N	Mean	SD	t-test
Presentation 2	Pos / Neg properties of selected object	Curse	48	42.69	23.92	$t(93) = .494,$
		Bless	47	45.23	26.30	$p = .623$
	Actor's	Curse	48	18.23	29.72	$t(93) = .008,$
	Influence	Bless	47	18.28	29.21	$p = .994$

Table 9

Correlations between survey items and measures of attribution on object properties

	OC	HRRE	PB	RTS	ITS	Rel	Presentation 1 Pos/Neg Properties	Presentation 1 Actor's Influence	Presentation 2 Pos/Neg Properties	Presentation 2 Actor's Influence
Ontological Confusion (OC)	r	0.098	0.306**	.363**	0.143	0.353**	0.057	-0.088	0.049	0.001
	p	0.333	0.002	< .001	0.161	< .001	0.576	0.392	0.637	0.995
History of Religious and Ritual Exposure (HRRE)	r	-	0.428**	-0.201**	0.427**	0.463**	-0.025	0.122	0.101	0.230*
	p	-	< .001	0.046	< .001	< .001	0.810	0.235	0.330	0.025
Paranormal Beliefs (PB)	r	-	-	-0.246**	0.362**	0.444**	0.089	0.133	0.219*	0.230*
	p	-	-	0.014	< .001	< .001	0.383	0.193	0.033	0.025
Rational Thinking Style (RTS)	r	-	-	-	-0.091	-0.165	-0.134	-0.031	-0.139	-0.085
	p	-	-	-	0.372	0.105	0.192	0.765	0.183	0.417
Intuitive Thinking Style (ITS)	r	-	-	-	-	0.297**	0.165	-0.001	0.095	0.096
	p	-	-	-	-	0.003	0.108	0.989	0.366	0.362
Religiosity (Rel)	r	-	-	-	-	-	0.092	-0.092	-0.196	0.101
	p	-	-	-	-	-	0.371	0.908	0.059	0.337

Discussion

Because ritualized actions cannot reasonably alter an object physically we predicted that *neither action-type will influence participant's rating of 'sameness'*. This was true in the first presentation, but not the second; in presentation two, when the action couldn't cause change more people reported it did. In this case it is worth noting the raw values, and we compare these results to Kapitány and Nielsen (2015), who found a similarly fleeting result. In the present experiment we believe it is likely Type-1 error. We make this argument given that, while there may have been a perceived difference between objects, it did not appear to alter participant preferences or other attributions.

With regard to intangible properties, we predicted that *participants will regard objects subjected to ritualized actions as more special than objects subjected to ordinary actions*. Unlike Kapitány and Nielsen (2015, 2016) we did not find any evidence that participants attributed specialness to acted-upon objects, either as a result of ritualized action or an actor's motivation.

And yet, when the researcher 'blessed' or 'cursed' an object we observed a significant and meaningful change in behaviour. A logistic regression indicated there was a difference but since we were comparing the bless condition and the curse condition directly, it was not immediately possible to determine whether the effect was driving by one, or both, kinds of goal information. By comparing the behaviour of those in each goal condition in presentation one (where goal information was not present) to their behaviour in presentation two (where it was) we strongly suggest that the effect was exclusively driven by the blessing rather than the curse, and this effect didn't appear to be limited by action-type. Since we predicted that *when goal information is present, the effect of describing an action as a blessing will only result in a higher likelihood of preference in the Ordinary condition and when cursed, across both action-type conditions, participants will be more likely to avoid acted-upon objects* we are forced to conclude that neither of these predictions were supported (despite prior evidence to the contrary).

To begin examining how ritualistic actions are perceived we examined what

participants could recall, and in how much details they could recall it. We predicted that *participants will report/describe more action units in the ritual condition than the ordinary condition*. In presentation one participants in the ritual condition recalled more action units, and did so with greater specificity than those in the ordinary condition. This supports our prediction that ritualized actions are represented as gestures, not behaviours, as participants were not able to usefully chunk information into more efficient units (e.g., 'he waved the cloth up and down on the side of the object', vs, 'he cleaned the object'). However, this difference was eliminated when goal-information was introduced (even though the difference was of a similar magnitude and direction) - we suggest here this effect is attributable to presentation of the goal information. In effect, participants were able to reconcile the gestures into behaviours.

Interestingly, even though goal information influenced participants preference, participants did not explicitly report that they believed the object had been imbued with positive or negative properties (given this result, it is unsurprising that participants did not report a difference between conditions regarding the actor's *ability* to imbue objects with such qualities; note also that such values were very close to floor). The disconnect between preference and the valance of an act directed toward the object is interesting, particularly given that it was only when an(y) action was called a blessing that preference was influenced (a finding contrary to prior findings). It is possible participants were either not aware they held a belief consistent with goal information (that it was blessed), or were not willing to admit it but acted consistent with the information provided nonetheless. An effect for which there is precedent, see: Nemeroff and Rozin (1994); Rozin et al. (1986); Savani et al. (2011); Subbotsky and Quinteros (2002). It may also be the case that participants genuinely do not hold a belief that a quality of the object has been changed, but interpret the information in a wholly ordinary way, where a blessing indicates some kind of positive pro-social sentiment between the actor and the observer. An even leaner interpretation is that participants interpret this information as a set of social instructions (which might also be considered a kind of demand effect) - it is as if the actor is saying "*Blessing are good, and I want*

you to take this one". In any event, the fact that goal information influence behaviour is interesting, and is broadly consistent with observations of real world behaviour (as well as conceptually replicating findings from the field of sympathetic magic; see: (Nemeroff & Rozin, 1994; Rozin et al., 1986; Savani et al., 2011; Subbotsky & Quinteros, 2002) even if it does not replicate the nuances of previous object-directed ritual action findings.

General Discussion

Rituals are a pervasive part of living in groups, and we begin to participate in them well before we are able to play an active role. Depending on where you happened to be born, you may have participated in a ritual within days of your birth, which may have included not being allowed to touch the ground (as with Balinese Hinduism (World Heritage Encyclopedia, 2017), being baptised, or having your genitals mutilated without your consent). Newborns are generally regarded as '*Homo potato*', and so it stands to reason they are unlikely to be able to actively share the rich exegetical, orthopraxic, symbolism of the rituals in which they are the star. Rituals have been frequently studied as they relate to group relations - identifying and causing belongingness, trust, and shared belief. Yet even here, there is evidence that children do not understand exactly what's transpiring. For example, children up to the age of 5 believe that a birthday party *causes* them to age rather than simply marking the passage of time; (Klavir & Leiser, 2002). The question we asked here was: *Does ritualized action change our perception of objects, and if so, how?* In approaching this question we built on the work of presented in the previous two chapters in several ways: First, we attempted to examine at what point in development (throughout childhood) did an (anticipated) adult-like set of responses appear. This was done in two distinct cultural contexts. Second, among adults, we examined behaviour (rather than self-report) and asked a range of additional questions that improved resolution on the underlying cognitions associated with ritual.

The ritual stance suggests that the observation of causally opaque and goal

demoted actions activates a normative response. It has been shown that both Adults and Children who *participate* in rituals identify more strongly with the group (Herrmann et al., 2013; Legare, Wen, et al., 2015; Legare, Whitehouse, et al., 2015; Watson-Jones et al., 2014), a pattern of responses consistent with the ritual stance. Yet there is no *a priori* reason why the ritual stance - which predicts a normative interpretation of ritualistic actions - should be *limited* to group-related rituals, or even the participation in rituals (as opposed to the observation of rituals). Many rituals are directed towards objects, and we appear to treat such objects differently. With good cause, we were interested in determining whether a normative interpretation applied in these contexts. Across three experiments, Kapitány and Nielsen (2015, 2016) demonstrated that objects subjected to rituals were perceived as more special and more desirable, despite being physically unchanged. In effect, we did not observe any sensitivity to object-directed ritualized action. Ritualized action, as revealed by the behaviour of children and adults, did not appear to make the focal objects more special, or to influence preference.

We also failed to compellingly replicate our findings regarding people's sensitivity to specific information regarding goal information. People appeared to respond by preferring an object that was blessed, independent of the type of action the blessing was associated with. While this was anticipated with ordinary actions, prior evidence led us to anticipate its absence when associated with ritual acts. Similarly, we anticipated that cursing an object (independent of action-type) would lead to aversion. We find no clear evidence of this at all.

There are several possible explanations for our observed results, and the apparent contradiction to previous work. First, with respect to both the adult and child data - the ritual stance may have limits: it simply doesn't apply to objects in the same way it applies to groups and people (and results of the first two chapters are error or artefacts). Second, our manipulation differed from successful manipulations previously employed in important ways (prior results were correct, and the present results are not comparable). Third, with respect specifically to the cross-cultural developmental data: Ritual-like adult cognition (as suggested by prior publications) doesn't emerge until the teen years.

Finally (within the same context), aspects of the present manipulation produced artefacts in the data in the cross-cultural context (i.e., I'm a WEIRD white guy).

I will address these concerns in reverse order. How do Ni-van children understand the presence and intent of a group of strangers (white, foreign academics) arriving in their community with gifts, then asking the children to participate in artificial scenarios? And specifically, what impact does this have on ritual-cognition? These communities represent well studied populations, who are comfortable with the presence of researchers. It is unlikely that our presence was, all things being equal, considered particularly disruptive. Several groups of researchers have worked among these populations, and we were generally treated as guests (which, if anything, presents the opposite problem for experimental hygiene - participants might have been over-eager rather than wary). At a general level, we do not believe this is a problem. However, we have not ruled out the potential problems associated with ritual-cognition. What does it mean for a stranger, un-associated with the group, to perform ritual actions? It is possible - and consistent with the ritual stance - that such a model exhibited either a) a mixed and confusing array of cues, or b) was not recognized as having any capacity to have 'ritual influence'. Ritualized actions are already confusing and confounding, and by introducing an additional set of cues associated with the model (being foreign, unable to speak the language, a different race, and not belonging to the group) any effect associated with *ritualized action* was suppressed. Likewise, such cues - rather than being confusing - might simply have produced in observers a lack of confidence that the actions being performed had any self-relevance. On each count we suspect this is not the case (though cannot - with perfect certainty - rule it out). We found the same pattern of null-results among children in Brisbane, and among those children, these criticisms do not apply. While it is entirely possible that the same observed behaviour between populations was the product of different cognitive mechanisms, it is not parsimonious to claim so. Particularly in light of the fact that these (and other) Ni-van children have demonstrated they are already sensitive to other ritual- and normative-experiments (Clegg, Wen, & Legare, 2016; Rybanska et al., 2017). For these reasons we

find it reasonable to conclude cues associated with the experimenter were unlikely to produce this pattern of results, that is, these results cannot easily be attributed to the fact that the experimenter was an out-group member, lacked ritual-authority, or was simply unusual.

Is it possible that adult-like ritual cognition doesn't emerge until the teen years (outside the range tested here)? Across both populations the mean age of participants was just over 6 years (with a standard deviation of 2 years), in which the maximum age was 13. Data reported by Kapitány and Nielsen (2015, 2016) show an effect associated with ritualized actions among a considerably older population (the reported mean age of the youngest sample was 19 years, the oldest sample had a mean of 35). Is it possible that adult-like behaviour associated with ritual cognition occurs somewhere during the teen years, and is not observable in childhood? It is the case that many important rites-of-passage, that mark a distinction between childhood and adulthood, occur in the early teens. Even among the Ni-van, males are not permitted to join the Kava ceremony (a male-only ritual) until they are able to grow a sufficient beard, while women are not sequestered and scarified (on Tanna Island) until their first menstruation. But while these are convenient and affirming examples of this hypothesis, there are frequently observed deviations. For example, the very same boys on Tanna island are circumcised when they are about 7 or 8 years old, and girls are scarified (to a lesser extent) when their older sisters have their first menstruation. Empirically, children in Vanuatu have demonstrated a sensitivity to ritual manipulations (Clegg et al., 2016; Rybanska et al., 2017). And of course, there is a strong legacy of western children responding to ritual manipulation. But perhaps this entire point is moot. We did not find the expected behavioural responses among adults (despite expectations based on prior research that we would). If we can have confidence in the adult data presented herein, then we have to assume that - given present methodologies - asking questions about the *emergence* of adult-like ritual cognition is unanswerable: adults do not show anticipated adult-like ritual cognition.

But stated so plainly we are forced to confront uncomfortable scientific and

methodological questions. Despite the fact it seems obvious that we treat ritualized objects as different from ordinary objects, we must ask: Were our manipulation and measures valid? This question is the most difficult to answer. As stated previously, three experiments - which were conducted online - produced behaviour consistent with the ritual stance (see empirical chapters one and two). Notably, the stimuli in these experiments (videos of ritualized actions performed over objects) were accompanied with a statement of social context (*'the actions you're seeing here belong to the x-ceremony of y-location'*). Here, when ritualized actions were presented *sans* context we did not find the predicted behavioural responses. This leads to three possible interpretations. One, despite the fact that we observed the behaviour online, the effect is not manifest *in situ* for reasons unknown. Two, the effect is not manifest *in situ*, because we omitted contextual information (suggesting that an explicit description of the actions as ritualistic is more important than ritualistic motor-features). And three, the ritual stance does not predict object directed behaviour, even though this behaviour was identified in the somewhat artificial context of an online testing environment. Greater time will be given to these points in the general discussion of this thesis, but presently we will argue that position three is the most reasonable interpretation.

So why is it reasonable to suggest that the ritual stance - that goal demoted and causally opaque acts are interpreted normatively - may not apply to object-directed rituals? The ritual stance predicts behaviour in various contexts when certain features are shared, such as active participation (Clegg & Legare, 2016a; Herrmann et al., 2013; Watson-Jones et al., 2014; Wen et al., 2015), and certain social considerations are present (Horner & Whiten, 2005; Kenward et al., 2011; McGuigan et al., 2011; Nielsen & Blank, 2011; Whiten et al., 2016).

To explore the first criticism, there is precedent for the study of ritual action when one is passive, and when (descriptions of) motor features are manipulated. Legare and Souza (2012) showed that the number of steps within an actions sequence, and repetition within an action sequences, leads to greater evaluation of ritual efficacy (i.e., greater likelihood the magical effect of the ritual sequence can be produced by the ritual

sequence). Which, it should be noted, were not necessarily group-related outcomes - they were outcomes much like those that I have previously manipulated (that is, to bless or curse an object). Further, in chapter two, we observed that ritual actions that were not associated with a goal, were the *most likely* to produce appeals to actions and intentions consistent with a ritualistic interpretation (compared to ritualistic actions with bless/curse information), and ordinary actions that were not associated with goal information were the *least likely* to produce such responses (compared to ordinary actions with bless/curse information; see table 5 of chapter two). Likewise in chapter two, ritualistic actions (particularly those without goal information) were recalled in qualitatively different ways from ordinary actions (consistent with theories that describe causal opacity and goal demotion, but not necessarily ritual). And so there is considerable evidence that 1) ritualized actions are perceived differently *in situ* and *in vivo* (*as presented here*) from non-ritualized actions, 2) ritualized actions produce a different pattern of responses (e.g., higher imitation) when participants actively engage in the ritual actions (Clegg & Legare, 2016a; Herrmann et al., 2013; Watson-Jones et al., 2014; Wen et al., 2015), and 3) ritualized actions produce different cognitions and behaviours when there are social considerations (i.e., such as who is present, and who demonstrated the given action; (Nielsen & Blank, 2011; Nielsen, Mushin, et al., 2014; Wilks et al., 2016). And yet, given all the converging evidence, we find that when such actions are directed towards objects, we lack evidence of their influence.

It may be that, through the lens of the ritual stance, activation of normative interpretations as a consequence of causal opacity and goal demotion is too great an explanatory leap for objects. Objects themselves are not social. Objects may become associated with social groups by various means, but it is - at a minimum - a mediated relationship between an object and its group. A group is constituted by people, it is nonsensical to say that a group is constituted by objects. At face value objects associated or involved in rituals are undeniably treated differently from objects that are not. Consider the difference between a wedding ring and an ordinary ring, a birthday cake and a typical dessert, and an Olympic medal and an exact replica. And yet here

we find that a series of causally opaque and goal demoted actions are not enough to arouse a response consistent with the ritual stance. Perhaps such actions are a necessary-but-not-sufficient element of ritual sequences, but this same claim does not hold when it comes to imitative behaviour or affiliation with a group (as previously discussed). Given the design of the present experiments we can tentatively conclude that within a behavioural context, ritualized actions do not arouse behaviours consistent with a normative response, and that those response (null though they are) appear, at least superficially, similar cross-culturally.

Finally, if we are take to assume a higher level of analysis - a step removed from the question '*does the ritual stance apply to objects*' - and address our original question: *Does ritualized action change our perception of, and behaviour toward, objects, and if so, how?* While I have spent many words discussing the behavioural aspect of this question, we have less extensively dealt with the cognitive question. It appears that ritualized actions *do* influence the way we perceive objects. Among adults we do find that causally opaque and goal demoted actions prompt a recall of the action sequence that has a greater number of action-units than ordinary actions and the description include more specific information. One way of conceiving this is that, were a naive individual to read the recollections of participants from this experiment, they would be more able to reproduce the actions *exactly* as they were observed despite not having witnessed the actions first-hand. In chapter two we saw that when actions were causally opaque, not only were they special, but people spontaneously made reference to the actor's intention and focus at about twice the rate as they did in the control condition - as other's have argued, we tend to build meaning on the fly (Wilder, 1978a, 1978b), that we are motivated to reconcile gestures into behaviours and to prioritize intentions and goals over other characteristics (Bekkering et al., 2000; Gleissner et al., 2000; Heider, 1958; Malle et al., 2001; Zacks et al., 2007; Zacks & Tversky, 2001; Zacks et al., 2001). In the present experiment we show what this looks like from the point of view of our memory of events - specifically - it manifests as reporting more action-units with greater specificity than the control action. It seems as though the answer to the

cognitive question is *'yes, ritualized actions are perceived (or at least cognitively-parsed and expressed) in a manner that is different from ordinary actions'*. It's just that this may not bear upon 'the ritual stance' as an explanation for behaviour.

General Discussion and Conclusions

I began this dissertation by asking *what comes to mind when considering ritual?* And so, over its course I have considered this question from as many points of view as time afforded. I have broken ritual down into its constituent elements, first separating out religious or supernatural beliefs, and simple appeals to tradition. What then remained was a series of actions and objects, devoid of context or claims of efficacy. Yet the idea that a ritual is merely a series of actions does not benefit our understanding, and indeed, seriously misrepresents the challenges (and interest) of the question. The idea that rituals are, in part, constituted by ritualized actions is not sufficiently explanative, for the features we consider important by common definition are not particularly unique to ritual (even though they are necessary). I argued that we need to consider the cognitive affordances of those actions. Action sequences we perform every day, like cleaning a coffee cup, are not particularly notable to an observer, and yet some of those very same actions, when altered only subtly, may leave an observer confused and reaching for an explanation (consciously or otherwise). It is not that the actions themselves are special, it's that - by way of the actions' relationship with causality, and, importantly, the kinds of inferences they allow us to make about the actor performing them - ritualized actions force upon us a cognitive challenge: it's no longer easy to determine *how* an action brings about an outcome, or even *why* someone would perform them. These features are respectively referred to as causal opacity and goal demotion, and I argue, they are what makes a ritual a ritual; they are what make it possible for us to understand that a baptism is not about cleaning a baby, that birthday candles are not related to food or eating, and that wedding rings are not simple aesthetic adornments. And so the question takes on a more literally tone 'what comes to mind when considering ritual?'

Commonly, ritualized actions (a constituent element of ritual) are said to be recognizable for *repetition*, *redundancy* and *stereotypy*. The performance of which is often *rigidly* determined and highly *specified*, and *formally* presented. All of which facilitates a drive to prioritize *accurate performance of the action* rather than accurate

reproduction of outcomes. Such actions, when performed by a group, may also feature *synchronicity* (Bulbulia & Sosis, 2011; Cohen et al., 2013; Fischer et al., 2013; Kapitány & Nielsen, 2015, 2016; Legare & Souza, 2012; Rappaport, 1999; Reddish et al., 2014; Tunçgenç & Cohen, 2016; Wiltermuth & Heath, 2009). Rituals also tend to exhibit causal opacity and goal demotion, but some have gone further to argue that these motor features cause them (Boyer & Liénard, 2006; Schjødt & Sørensen, 2013). Over the course of this dissertation, I have arrived at the following definition which, eventually, I was able to fully articulate in my final empirical chapter: *ritualized behaviour is typically causally opaque and goal demoted as a consequence of the repetition, redundancy, formality, and stereotypy of the motor features, and as a result we prioritize accurate performance of process over outcome.*

Causal opacity describes the degree to which an action affords an observer the ability to determine how the action brings about an outcome. The understanding need not be particularly in depth, or clear-minded, and can operate at the level of folk physics. To observe someone cleaning a dirty cup with a cloth allows for the inference that through the application of mechanistic forces above a particular threshold, otherwise-difficult-to-remove stains can be dislodged. Though no-one would describe it like that in the real world - most would say ‘the cloth rubs away the dirt’; it is a causally transparent action. Likewise, to observe a helicopter lifting-off is causally transparent: it is clear that the relationship between the speed of the rotating blades governs whether the helicopter remains on the landing pad or hovers above it. Some have described the difference between causal opacity and causal transparency as the difference between the start-state and the end-state of the objects subjected to actions, where the states are the same the mechanism of action is opaque, and where they are different, they then are transparent. Even if it not possible to clearly and accurately describe how an action causes an outcome it is still considered transparent if it is potentially knowable (Legare, Whitehouse, et al., 2015; Watson-Jones et al., 2014).

But this cannot be completely accurate. If the universe is the same after a set of actions as it was before, then no mechanism needs to be determined. It is neither

possible, nor reasonable, to describe the mechanism of causation if your dirty coffee mug is still dirty two minutes later, even if you were waving a cloth at it at a distance removed. A better description of causal opacity is when the causal dependency structure of the actions is disrupted (independent of whether the action sequence causes an outcome or not (Schjødt & Sørensen, 2013)). Under this definition waving a cloth in a cleaning motion at a remove from the mug is a disruption of the typical causal relationships observed when the cloth is brought into contact with the mug. But the real utility of this definition is apparent when considering examples in which the end state varies from the start state. Consider a helicopter with rotating blades attached, not on top of the vehicle, but on one side. To observe the the blades increase in speed, and to witness the helicopter lift vertically as a result is to see the structure of cause-and-effect disrupted, but an effect brought about nonetheless. This is an extreme example, and does not involve [ritualized] action, but it highlights how effective the latter definition can be. Under the start-end-state-equivalency model, this would not be an opaque causal process, but a transparent one (an absurd proposition).

However, accounting for a difference between start- and end-states is important, as many sequences of actions (including ritual sequences) include both relevant and *ir*relevant causal actions ostensibly to bring about a single outcome. Consider a circumcision ritual (in the Jewish tradition): a sharp blade is causally required to alter the body of the child, but it is not [causally] required that the cut is made by someone of the Jewish faith, that an intermediary carry the child between the mother and the father (a *kvater* or *kvaterin*), that the event take places during daytime eight days after birth inside a particular building, or that blood is orally sucked from the wound rather than wiped away by a cloth (*Metzitzah B'Peh*)⁶. Causal opacity, then, describes the degree to which an action affords an observer the ability to determine how the action brings about an outcome, where the actions disrupt typical causal structures by either failing to cause an outcome, or where they are not causally related to the outcome.

⁶Admittedly this description involves a range of extant ritualistic elements which occur in conjunction in only some communities.

Goal demotion (and its counter-part, goal apparentness) is the degree to which an action affords an observer insight into the goal, intention, or motive of the actor performing it. This is an important and informative distinction to draw, for in instances where the start- and end-states are equivalent (where it's not possible to dwell upon causal processes) it is reasonable to wonder *why* those actions were performed by the actor. And so, if we consider the cleaning-action performed at a remove from a cup, we do not ask *how* that is happening, but *why*. Thus, it is more useful to describe the action as goal demoted (because the action does not afford an insight into the actor's mind), even if it may also be technically appropriate to consider the actions causally opaque, too. If we apply this logic to the circumcision ritual, even if it's impossible to ask *how* a Jewish person performs a superior cut, it is very easy to understand, from the point of view of goals and intentions, *why* a Jewish person is required to make it.

I hope to have illustrated this claim - that causal opacity and goal demotion are dissociable in theory and in practice - and importantly that they are *generated* by specific features and contexts in which motor sequences are performed (Boyer & Liénard, 2006; Schjødt & Sørensen, 2013). I have done this *in theory* through the use of the 'Hotel Attendant problem'. The Hotel Attendant problem describes a series of ordinary actions that conform to the common definition of ritual but are, in fact, wholly ordinary. But when these actions are placed into a context in which they force upon the observer no clear causal mechanism, and no clear insight into the motive for their performance, they suddenly afford a ritualistic interpretation. And I have done this in practice across my empirical chapters. Doing so empirically represents a considerable step forward in the literature, as many consider each element theoretically important (Boyer & Liénard, 2006; Legare & Souza, 2012; Liénard & Boyer, 2006; Rossano, 2012; Schjødt & Sørensen, 2013; Sørensen & Nielbo, 2013), but few have attempted to examine the elements distinctly (particularly with regard to goal demotion, but see: (Fux et al., 2013; Mitkidis et al., 2014; Nielbo & Sørensen, 2011)). Herein, I have taken considerable steps forward by methodologically separating and demarcating the role of these features in stimuli and analysis.

But why is it important that the role of causal opacity and goal demotion are elevated in the study of ritual cognition? Beyond the points made that wholly ordinary motor features (repetition, redundancy, formality, etc.) occur in wholly ordinary sequences, their inclusion (particularly in light of greater theoretical clarity, presented here) allows us to address underspecifications in existing ritual theory, and to do so using ordinary features of human cognition (an important element of a CSR approach to investigating religion and ritual). The ritual stance is one theory which describes how the observation of, and the participation in, rituals (where those rituals tend to revolved around the manipulation of objects) is governed by normative motives (Herrmann et al., 2013; Legare & Herrmann, 2013; Legare & Wen, 2014; Legare, Wen, et al., 2015; Legare, Whitehouse, et al., 2015; Watson-Jones et al., 2014). Often these manipulations, however, rely on semantic cueing, in which statements of the form “*this is how the yellow group do it, everyone in the yellow group does it like this*” make it extremely difficult to demarcate whether ritual actions cue normative responses, or such cuing produces normative responses. Further, the theory - which has considerably explanatory power to date - assumes normative responses only when groups are involved: it does not specify whether such responses will occur when the subject of the ritual is an object. Over the course of this thesis I have investigated this possibility, and found a mixed pattern of results which may support the predictions of the ritual stance, however, I have found the question more complicated than it first appears, with short-comings in behavioural and developmental contexts.

Another theory, which benefits from the increased theoretical clarity, is the hazard precaution and action parsing system (Boyer, 2001; Liénard & Boyer, 2006). This theory provides some interesting hypothesizing on the ultimate origins of ritual, as well as the proximal factors that maintain it. Specifically, if ritualistic actions activate anticipatory threat-responses, then those response ought to produce some kind of systematic pattern of behaviour toward the focus on those actions. Simultaneously, the features that allow us to recognize and parse ritualistic action as a kind of action different from ordinary action should be measurable in ritualistic contexts. For this latter claim, I have

produced answers of increasing resolution which support predictions made regarding how we observe and perceive (and recall) ritualistic action. However, with regard to responses such perceptions produce, I am forced to draw more conservative conclusions.

And I have also attempted to introduced generalizability as well as methodological clarity. The ritual stance is implicitly universal, and the hazard precaution system is explicitly so. In the introduction I wrote the following:

“While the tendency for those within the field of cognitive sciences of religion is to study far more diverse populations than other fields, which - in theory - allow for more generalizable conclusions, it is still the case that any psychological theory that aspires to universality must take into account cultural considerations, and any theories that claim to be evolutionary, must consider the trait’s development (Mesoudi, 2011; Nielsen & Haun, 2016)”

To this end, after establishing a protocol and observing a series of encouraging results (in two separate populations: Australia and America), I attempted to examine if, and when, children in two diverse cultures responded (Australia and Vanuatu). The results I produced here, that were behavioural in nature (both among children and adults) posed the greatest challenge to clarity of the questions under consideration - for the results were generated in a fair test under valid ecological conditions, and yet did not support the hypothesis.

Across all three empirical chapters (comprised of five experiments across three cultures including two distinct age groups) I employed highly matched stimuli, common methodologies, and consistent predictions and analyses. I examined, in all of these contexts, the responses of individuals after they observed a model focusing ritualistic actions on objects.

In empirical chapter one we found that people who observed ritualized actions (specifically, causally opaque and goal demoted actions) that were focused toward one object in an array of identical objects did not generally perceive those actions as producing a difference among the objects (which was the same pattern observed when

the actions were wholly ordinary). However, ritualized actions did produce a perception that one object within the set was special compared to alternatives (an effect not produced by ordinary actions). Further, ritualized actions produced in participants an increased preference for the acted-upon object. When these actions were presented with contextual information, that the actions the participants observed belonged to a specific social group (that participants were not familiar with) the effect of specialness and desirability was amplified. In a second experiment, when we manipulated the valence of the contextual information (from benign and unknown, to negative/sinister) we found (unexpectedly) that the influence of context disappeared (even though we predicted a reversal).

I concluded that ritualistic actions do bear upon people's responses towards objects, both in terms of their evaluation of the object (as more special) and in regard to their self-reported intentions (the objects were more desirable). These findings appeared consistent with predictions made by the ritual stance. That benign social considerations improved these attributions, and that sinister social considerations did not influence the results, something I interpreted as also being consistent with the ritual stance. Rituals are, after all, social actions. A cue that a set of actions belongs to a group should serve to enhance responses consistent with a normative drive. We replicated, in two studies, the role causal opacity and goal demotion play (examined in conjunction) with respect to perceptions and reported intentions.

In empirical chapter 2 we employed the same ritualized actions (with benign social context) which, taken alone, were causally opaque and goal demoted, but through written cuing manipulated whether participants had access to the goals and intentions of the actor. We replicated the effect of ritualized action alone (without goal information) - again, such actions did not produce a perception of physical difference among the objects, but did produce perceptions of specialness, and self-reported intentions of preference. Ordinary actions, again, appeared to make no difference. In manipulating the goal information, we told participants that the actions they were observing were either blessings or curses (*performed to bring about good/bad luck, and*

good/bad health). These manipulations did not change perceptions about physical difference, or about specialness, but did influence preference for objects in the predicted directions. Notably, the effect of curses and blessings was observed when the actions were wholly ordinary, but we observed only an effect of curses when actions were ritualistic (suggesting ritualized actions and positive by default). Again, we find support that causally opaque and goal demoted ritualized actions influence participants in a manner consistent with the ritual stance. We further demarcate the role goal demotion played, and showed that introducing positive goal information to ritualized action doesn't influence participants' responses, but introducing negative goal information does while the role of goal information on ordinary actions appears to play out in intuitive and predictable ways.

Additionally, we took initial steps to show that these well matched stimuli, which vary by the degree to which causal relationships are determinable and goal information is provided, influence how participants process what they observe. Consistent with predictions made by the hazard precaution and action parsing theories, we show that when observing ritualistic actions participants report paying attention to different features of the action. When asked what 'special' meant to the participants, we found that rituals without explicit goal information reliably produced appeals to goal information at rates greater than when rituals have explicit goal information provided (and the opposite pattern of results was observed when the actions were ordinary). This observation conceptually replicates prior findings that ritualistic actions are perceived and processed as different from ordinary actions. Thus providing a plausible mechanism for identification and response.

In experiment one of empirical chapter 3 we examined, among children in two distinct cultures, whether or not they produce an adult-like pattern of responses to ritual action. Here, we simplified the design, presented fewer options in our array of choices, and minimized language cues. When children (in both cultures) observed a model performing a ritualistic action (across two presentations) on one of two bowls (which each contained a reward), it appeared not to influence their subsequent

preference and decision at rates different from ordinary action or chance. It was not possible to measure what occurred at a cognitive level among these children, but as far as their behaviour is concerned, they did not respond in a manner consistent with prior data (despite the fact that children in both of these locations had been shown to be sensitive or responsive to ritual-type manipulations conducted by other researchers). Nor did we observe an age-related effect - we could not conclude that as children get older they become more adult-like with regard to the ritual response.

In experiment two of empirical chapter 3 we subjected participants to the same stimuli and manipulations as in chapter two, but did so using live, rather than video, presentations. In the first of two presentations, participants saw a model perform ritualistic (or control) actions on an array of three identical objects. In this presentation the actions were both causally opaque and goal demoted. In the second presentation the same kind of action was performed on a similar array, and we indicated that the actions being performed were either a blessing or a curse. Here we failed to find the predicted effects associated with ritualistic action. Ritualistic actions alone did not produce specialness, and did not produce preference (as measured by actual behaviour). Not only is this contra to predication made by the ritual stance (at least inasmuch as preference is concerned), but contrasts starkly with evidence from three experiments in the first two chapters. However, some degree of ritual cognition was evident; when participants were asked to recall in as much detail what they observed in the first presentation, their responses were more detailed and specific than those in the control condition. Though we predicted that we would observe this same pattern of results in the second presentation (when the goal of the actor was apparent) we did not. However, in hindsight, we believe this is consistent, as goal information ought to allow participants to reconcile the otherwise-difficult-to-explain actions with reference to the information provided. We cautiously propose support for hypotheses associated with action-parsing, and modify our prior beliefs regarding the ritual stance.

In the same experiment we observed that the pattern of preference, while not influenced by the kinds of actions performed, was influenced by the goal information

(presentation two). Blessed objects were preferred many time more than cursed object. This finding contrasts the findings presented in empirical chapter two, in which we reported that blessings had no impact on ritualistic actions, but did on ordinary actions. The possibility remains open that that ritualistic actions may play some interactive role when intentions are present, but we are far from being confident or conclusive on this matter.

And so what can we conclude from this series of experiments? It seems safe to say that we perceive ritualistic actions as different from ordinary actions. When participants are asked to explain what they saw (compared to ordinary actions), they appeal to distinct, theoretically-consistent constructs (such as an individual's intention), and do so with greater clarity (as a consequence of top-down error detection, they identify more components of action, and associated specifics). This cannot be understated. It is one thing to predict a behavioural response to observing ritual, but the devil is in the detail, and there's an evidential burden of those in the field to define how we can 'see' a ritual at all, before hypothesizing how and why we respond so. I have shown that even when behaviour does not suggest ritual cognition, participants still see ritualistic actions differently - suggesting interesting hypotheses: The question no longer is '*Why do we act in a normative manner when we see rituals?*' (for example), but '*What is it about about actions which do not afford causal understanding or intentional predictions (cognitively represented by schemas), that activate a normative drive?*'.

To contextualize this claim: we can now examine the hotel attendant problem and explain why a forest rather than a hotel room affords a ritualistic interpretation. To perform cleaning actions on a mirror or a cup, which may or may not be dirty, activates the schema of *cleaning*. For things that can be dirty or clean, this schema is appropriate. However, for things that cannot be typically 'dirty' or 'clean', like a tree or a leaf, it becomes inappropriate to use the cleaning-schema. Thus, recognition that a series of typical actions (which feature repetition, formality, stereotypy, redundancy) is now being applied to a situation in which the goal of cleaning is not appropriate, represents a meaningful corruption of the typical causal-dependency structures of the

cleaning action. And because it makes no sense to clean a tree, one cannot attribute the goal of 'making clean' to the agent performing the action. Thus, we see a series of ordinary actions - normal in a hotel - become ritualistic when they force upon the observer causal opacity of action and outcome, and a goal demoted quality regarding the agent who performs them.

But thereafter it becomes more difficult to draw clear conclusions. Using the framework of the ritual stance we predicted that the normative responses that rituals encourage in individuals when interacting with groups would apply to individuals interacting with objects. This question is not merely a curio, as there are so many instances in one's life when ritualized objects are treated differently from ordinary objects (not to mention that interactions with objects are frequently governed by a norms). Birthday cakes are different and special in a way that other cakes are not, and to interact with a birthday cake in the way one would with an ordinary cake would be inappropriate, as would the reciprocal: A late night slice of cake is fine, but if at 11:37pm you decide the slice needs to have a lit candle implanted upon it and immediately extinguished, then you might very well want to question what you're doing. We showed that people tend to attribute a *specialness* to ritualized objects. However, this was only found in online samples (albeit, three online samples with a combined N exceeding 1300 people). The effect was not replicated when people observed the same actions in a live context. Beyond the reality of the situation one potential difference between the online and the virtual environment was that in the online sample we provide a social context: we informed participants that what they were observing belonged to a particular social group. Yet, in one condition of both experiments one and two, this was not present, and we still observed that people were more likely to make attributions of specialness when actions were ritualized (compared to ordinary). Why is it, then, that the effect disappeared under more ecologically valid circumstances when it had been robustly observed elsewhere?

It may be the case that participants were more self-conscious about engaging in magical thinking when clearly under lab conditions. The actions are obviously absurd,

and to reveal that you think they caused some intangible effect in the world may reflect upon you poorly. Contrariwise, participants online may have been susceptible to the expectation effects. The actions are obviously absurd, but it may have followed that this absurdity implied that the experimenter wants me (the participant) to say ‘*this one is special*’ (though, if this is the case, such expectation effects were not observed in the control condition). It might also be the case that in our online samples we had about 100 participants per cell, and in our lab sample we had only 50. The Odds Ratio (an unstandardized measure of effect size) indicated that the effect of ritualized action was frequently greater than 2.0 (meaning participants were more than twice as likely to say that specialness was present than absent). Statistically, even if an effect is real, the chances of making a Type II error (incorrect rejection) are not only possible, but expected (Lakens & Etz, 2017). And so it is tempting to suggest that, mediated by the cognitive processes that allow us to recognize rituals, we may also make attributions to a ritualized object’s status using the label ‘special’, even if we only observed it in three out of four experiments. As comforting as this conclusion is, that the following results are also null casts a little more doubt.

In the very same behavioural experiment we found no effect of ritualized action on an individual’s preference for objects. This was the central dependent variable - do people exhibit normative responses when they observe ritualized actions performed towards objects? We found this effect online when people were asked ‘Which drink would you select to drink?’, and so it was unexpected that these self-reported intentions did not match actual behaviour. The potential explanations of the null effect with regard to specialness may also apply here, it might be a case of self-presentation bias in a live context, or expectation effects in the virtual context. The same follows with the argument about expected null findings, but it is striking that it wasn’t *either* specialness *or* preference that was found to be null (allowing for the generous interpretation of Type-II error), but both. This should lead any cautious scientists to lower their subjective confidence in the claim that the ritual stance applies to objects as well as groups.

It should be noted, however, that the role of goal demotion did influence participants behaviour (though, matching prior results, it did not influence ratings of specialness). When an object was cursed it was avoided, and when an object was blessed it was desired (more so in the control condition than the ritual condition). As with earlier experiments, this supports the claim that goal demotion is unique from causal opacity accounting different responses (causal opacity, and ‘*how*’ question relate to attributions of specialness, while goal demotion, and ‘*why*’ questions related to preference), and (weakly, albeit with precedence) suggests that goal demotion and causal opacity interact in interesting ways.

An additional theoretical concern is integrating the finding that children don’t exhibit preference toward ritualized objects. If it is the case, as suggested in the final empirical chapter, that there was something about the methodology in both the developmental context and the adult context which nullified the anticipated effects then we can simply dismiss the findings as the consequence of sloppy methods. But there is no clear justification for this conclusion, and I maintain that the methods employed were *a priori* theoretically appropriate. It seems less likely that children are susceptible to self-presentation bias (explaining a lack of preference), and if anything, may be more sensitive to expectation effects than adults (who are likely more able to hold an expectation and a personal intention in mind in a dissociable manner). It is possible that, despite the null effects observed amongst the live behaviour of adults, an effect does exist - yet the children we measured were below the threshold for exhibiting adult-like cognition (a point explored previously). To integrate these findings then, we must be conservative, and again, lower our subjective confidence in our assertions.

Does the ritual stance predict normative responses towards objects? We know that ritualized actions toward objects are perceived as not-ordinary, and that there is - on the weight of things - more evidence that people perceive specialness and form preference than evidence failing to show this. But, the evidence that fails to show it is more ecologically valid, employing real world stimuli and rewards. Published work on the ritual stance (Herrmann et al., 2013; Legare & Herrmann, 2013; Legare & Wen,

2014; Legare, Wen, et al., 2015; Legare, Whitehouse, et al., 2015; Watson-Jones et al., 2014) rarely demonstrates null effects. It is unclear whether work conducted by those who examine the ritual stance is prey to file-drawer effect, or any other practice (intentional or otherwise) which might produce such consistent published results. As clichéd as the following claim might be, more research is required.

That said, I am in a position afforded those who write a thesis to offer my opinion on the evidence presented. In light of the fact that we clearly treat ritualized objects differently in the real world, that rituals and ritualized objects are ubiquitous the world over, that rituals clearly influence the identity of individuals and groups, that all stimuli herein presented was constructed according to a robust *a priori* definition, that we clearly *perceive* rituals as not ordinary, and that the weight of evidence suggests people do attribute specialness and generate preference, then I would argue the hypothesis is moderately supported. Not only do rituals tend to influence the way we see ritualized objects, but we subsequently interpret them as having a special status, and generally (in the absence of specific goal-related information) find such objects desirable. That positive goal related information tends to have far less an influence on ritualized actions than does negative, and that both positive and negative have a far greater influence on ordinary/control actions also supports this position - for while 'pure' ritualized actions are causally opaque and goal demoted, rituals more broadly naturally manipulate *both* elements. Thus, I submit that it is the case that the ritual stances applies to objects, though this needs to be examined and replicated further. It may be the case that, work herein presented, demonstrates an absence of evidence. It is less clear whether the hypothesis has been convincingly falsified - there is not evidence of absence.

A more salient contribution, I would argue, is the increased theoretical clarity regarding the distinguishable roles both causal opacity and goal demotion play in ritual cognition. The finally formulated definition proposes not just co-occurrence of these features in conjunction with repetition, redundancy, formality, stereotypy, and synchrony, but that these qualities *produce* causal opacity and goal demotion, via a clearly articulated cognitive pathway - anticipated by Boyer and Liénard (2006);

Liénard and Boyer (2006) - and further demonstrated here. This empirical work allows for greater specificity in the questions we can ask about rituals. For it is no longer the case that we simply *'know it [a ritual] when we see it'*, but that we have greater insight into the cognitive processes *'... when we see it'*.

Having addressed earlier the question *What comes to mind when considering ritual?* several other questions were proposed. The first two relate to a proximal explanation of ritual, and were *'How do we recognize this act as something that is not ordinary?'* and *'why do we continue to perform rituals?'*, while the third was addressed the ultimate question of *'why does anything like a ritual exist at all?'* I think it is the case that of the three questions, the first has been addressed. The work presented herein show not only that we do see rituals as different from ordinary actions, but how and why. But the broader question of *'why do we continue to perform rituals'* may not have been addressed, and I raise it here to introduce a number of future questions.

Given that rituals are perceived and recalled in more detail than ordinary actions, might it be the case rituals persist (over other sequences of action) because they convey some kind of memory advantage? Others have written on the way ritual interacts with memory. Atkinson and Whitehouse (2011); Whitehouse (1992) argues that doctrinal rituals (which most closely match the manipulations herein presented) allow for the creation of semantic memory associated with group-defining beliefs and practices, while Schjødt and Sørensen (2013) argue that such ritual deplete cognitive resources, making memory for specific events more difficult. This could be addressed with a series of studies examining the fidelity of ritual performance in transmission chains. Based on the research presented here, I would predict that sequences that contain ritualistic elements would propagate more effectively and with less error through populations, due to the fact that such actions appear to be recalled at a higher resolution and in more detail than ordinary counterparts. If this is shown to be the case, it might also lend support to other theories of ritual cognition (for example, positive evidence may support Whitehouse's Modes Theory of Ritual, while negative evidence may support the Cognitive Depletion Model). An additional prediction might also follow that, in

societies that do not rely on written information (i.e., some traditional extant societies, and any society from the pre-literate epoch) that cultural technological sequences (such as producing medicines, tools and artefacts, or conveying important social information about what is safe to eat, and where is safe to visit) might be more likely to be ritualized or contain ritualistic elements. But since we rarely see sequences of action that are exclusively ritualistic (particularly as the length of the sequence increases), it follows that there is likely to be some frequency-dependent optima for ritualistic action in enhancing their transmission advantage. This kind of research could be modelled on the work of those who have shown transmission advantages for particular kinds of *ideas* within cultural construct (Banerjee et al., 2013; Norenzayan et al., 2006; Tehrani, 2013; ?).

I propose that one of the reasons we may still continue to perform rituals is because they are more salient and arresting than the alternatives (in much the same way particular folk tales and supernatural beliefs persevere compared to mundane alternatives). This line of argument may also suggest a novel ultimate prediction: rituals were never deliberately formed, but were perhaps '*hopeful monsters*' or accidental '*good tricks*' arrived upon by chance (or at least, without explicitly deliberate top-down planning), that, when performed arrested the attention of those around them in way that non-ritual could not; or that such beneficial errors in motor sequences could do the work that would otherwise be required by lengthy semantic explanations).

Though the appeal to normativity might not be the most parsimonious mechanism here, it is not an incompatible aspect of these predictions. Others have made claims that flirt with these predictions. Legare and Nielsen (2015); Nielbo and Sørensen (2015) have suggested the phenomena of over-imitation, and other similar ritual-related ideas, allow for children and 'cultural novices' to acquire important social skills that enable them to enter into a community and maintain their standing. It is, on the face of the claim, fair: If I were to meet a woman from a different culture, and I wished to marry her and become a part of her culture, I could not remain ignorant of how a marriage is executed and what it symbolises. That children (and novices) learn to do normative

and ritualistic actions cheaply (as far as the beneficial memory advantages afforded by the ritualism go), and by making small incremental gains in performing normative actions, they could very reasonably provide a series of important cultural stepping stones to become a functioning, accepted member of their own community (in much the same way I would have to if I married in such an environment).

And yet, on the assumption all my findings are in error, the fact that we do have ritualized objects in our everyday lives, and that those objects are treated in a manner different from ordinary objects, still requires explanation. Is it merely a pattern of associations? That rituals themselves do nothing other than focus our attention on one of many objects, and by focusing our attention (and frequently co-featuring a host of explicit or dogmatic beliefs) preference is formed, something similar to a ‘familiarity effect’ (Coupey, Irwin, Payne, Irwin, & Payne, 2014). It is the case that I cannot tell a wedding ring from a gold band unless I have been exposed to the objects’ history (either as a witness, or been provided this information prior) - there is nothing *essentially* different about the two objects available to the naive observer. Alternatively, can cognitive dissonance (Brehm & Cohen, 1962) explain the effect? One train of thought might follow that a wedding band must be special, because I’ve clearly invested time and effort into placing it on my betrothed’s fingers. Attempts to falsify predictions that rituals *cause* attributions of specialness and preference might investigate whether there are simpler explanations than normativity at play.

Finally, if it is the case that a veridical explanation of ritual is rich enough to require abstract thought, it becomes increasingly important to examine the questions from a developmental and evolutionary point of view. The question of ‘*when do children demonstrate adult-like ritual cognition*’ is straight-forward enough (though, apparently, not so straightforward that I was able to deliver a simple answer). Such a question should, as a first step, require additional testing. Should it prove as difficult as I have so far observed, demarcating (and investigating) the steps between over-imitation (as robustly established by many other scholars) and ‘ritual’ (as proposed in empirical chapter two) will be a necessary (and methodological step-wise) procedure.

A much more complicated and interesting question might be when it arose in our evolution. The fact objects and artefacts persevere throughout deep-time in a way that behaviour doesn't allow for interesting speculation on when ritualistic actions appeared. By about 74kya early Homo were burying their dead with funeral goods (d'Errico & Backwell, 2016), implying abstract thought, but does this also imply a commitment to ritual in the way it has been operationalized here? Recent findings, such as the Neanderthal ring-shaped structures (dated to about 176kya) come to my mind, which appear to conform to a specific shape (though size varies), and were found 336 meters from the entrance of the cave, and which show evidence of fires placed on the rings, rather than on the floor (Jaubert et al., 2016). This behaviour is suggestive of a fit with the definition of ritual presented (at least insofar as the consequences, but not the practice thereof, can be observed). The rings are repetitive, apparently redundant, structured in such a way as to suggest formality, and made to a kind of specification which may have emphasized process over outcome (not to mention the fact that the task of making such circles would have been much easier in the light!). Moving further (cladistically) afield, more recent evidence has suggested 'ritual drumming' in chimpanzees (Kühl et al., 2016). Whether or not this is the case (it is my opinion that such a claim is a stretch) examining whether other Great Apes (or even other highly social, or artefact using non-humans) respond to causally opaque or goal demoted actions in a systematic way might provide interesting insight into the ultimate questions surrounding our ubiquitous use of rituals.

That so many interesting questions remain in the psychological investigation of ritual is encouraging, but their investigation requires scholars to move afield from questions that repeatedly examine the relationship between rituals, groups, and identity, to better uncover the hidden workings of the phenomenon. The empirical work presented here has improved our resolution of understanding inside an under-researched aspect of ritual cognition - namely, the relationship between rituals, cognition, and objects. This work has also motivated me to address some of the consequent hypotheses that relate to memory, cultural evolution, and comparative research. Further, the CSR

approach to understanding the area of ritual cognition, an area so rich in narrative, history, subjective musings, and historical speculation, has proven highly fruitful and enduring, for both myself and the scholars I admire and respect. While there are those who conduct research on the role religion (as a complex) plays from an evolutionary point of view, fewer examine the proximate and ultimate role ritual has played. And so here, I hope to have addressed the question ‘*What comes to mind when considering ritual?*’ in such a way as to answer a specific subset of questions in a robust and informative manner, but also to have generated a line of enquiry that may lead other scholars to examine a range of ritual-related phenomenon that we know too-little about.

Appendix

Appendix A

The novel 'history of religion and ritual exposure' survey (7-point Likert Scale).

How frequently do you:

1. Knock on wood
2. Cross your fingers
3. Avoid walking under ladders
4. Avoid opening an umbrella inside
5. Throw salt over your shoulder if you spill it
6. Attend formal worship services (like those held in a Church, Synagogue, or Mosque)
7. Perform informal religious rituals in a group (like before a sporting match or a family dinner)
8. Perform private religious rituals individually (like prayer, cleansing, absolutions, or salat)

Would you:

9. Expect to see candles on your birthday cake
10. Expect to see candles on other's birthday cakes
11. Stand for the national anthem
12. Expect others to stand for your national anthem
12. Give flowers to express an emotion like sorrow or grief
13. Expect flowers in times of personal sorrow or grief
15. Wear particular colours or items of clothing to bring about good luck
14. Perform certain actions before or during stressful events (like before a speech, or during an exam) in order to manage your emotions

Appendix B

Table B1
Table of correlations between survey items and dependent variables of Experiment 1 (University Population: N = 101).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 History of Religious and Ritual Exposure	-	.278**	0.003	.330**	.361**	.234*	0.169	0.12	0.156	0.042	0.125	-0.166	-0.002	0.096
2 Paranormal Beliefs		-	-.206*	0.181	.334**	0.029	-0.058	-0.006	-0.017	-0.107	-0.038	-0.09	-0.053	0.158
3 Rational Thinking Style			-	0.063	0.083	0.104	0.06	0.084	0.03	0.119	0.152	-0.055	0.055	-0.132
4 Intuitive Thinking Style				-	-0.001	0.15	0.107	0.108	-0.056	0.081	-0.042	-.232*	-0.174	0.001
5 Religiosity					-	0.109	.225**	0.006	0.042	-0.037	0.078	-0.093	0.051	-0.138
6 SAME Scores Block 1						-	.639**	.668**	-.404**	-.315**	-.295**	-0.027	0.001	0.019
7 SAME Scores Block 2							-	.569**	-.235*	-.306**	-.245**	0.032	-0.047	-0.126
8 SAME Scores Block 3								-	-.234*	-0.182	-.290**	-0.069	-0.097	-0.072
9 SPECIAL Scores Block 1									-	.675**	.806**	0.189	0.097	0.042
10 SPECIAL Scores Block 2										-	.673**	0.013	-0.067	0.002
11 SPECIAL Scores Block 3											-	0.137	0.065	0.088
12 DRINK preference Block 1												-	.602**	.322**
13 DRINK preference Block 2													-	0.162
14 DRINK preference Block 3														-

Note: Correlations blocked in Gray are the correlations between survey items and dependent variables.
* p < .05 (2-tailed).
** p < .001 (2-tailed).

Table B2
Table of correlations between survey items and dependent variables of Experiment 1 (mTurk Population: N = 373).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 History of Religious and Ritual Exposure	-	.406**	-0.067	.258**	.563**	0.022	0.012	0.027	-0.006	-0.045	-0.008	0.012	0.091	0.019
2 Paranormal Beliefs		-	-0.091	.307**	.540**	-0.031	-0.012	0.009	-0.043	0.016	0.007	-.105*	-0.059	0.002
3 Rational Thinking Style			-	-0.069	-0.057	-0.081	-0.028	0.013	0.073	0.041	0.023	-0.015	0.04	-0.007
4 Intuitive Thinking Style				-	.204**	-0.062	-0.038	-0.011	0.021	-0.001	0	-0.094	-0.012	0.059
5 Religiosity					-	-0.001	0.003	0.026	-0.067	-0.077	-0.082	-0.011	0.044	-0.014
6 SAME Scores Block 1						-	.525**	.550**	-.446**	-.294**	-.272**	-.125*	-.117*	-0.022
7 SAME Scores Block 2							-	.746**	-.259**	-.422**	-.346**	-.129*	-.175**	-0.08
8 SAME Scores Block 3								-	-.194**	-.325**	-.403**	-.122*	-.172**	-.137**
9 SPECIAL Scores Block 1									-	.478**	.478**	0.043	0.083	0.107
10 SPECIAL Scores Block 2										-	.686**	.257**	.322**	0.063
11 SPECIAL Scores Block 3											-	.241**	.271**	0.09
12 DRINK preference Block 1												-	.555**	.268**
13 DRINK preference Block 2													-	.238**
14 DRINK preference Block 3														-

Note: Correlations blocked in Gray are the correlations between survey items and dependent variables.
* p < .05 (2-tailed).
** p < .001 (2-tailed).

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