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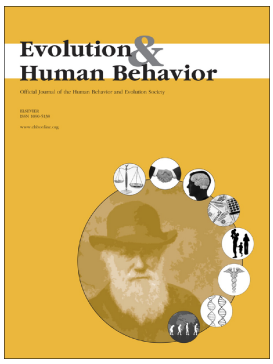


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# The Influence of Goal Demotion on Children's Reproduction of Ritual Behavior

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Abstract

Rituals are a ubiquitous feature of human behavior, yet we know little about the cognitive mechanisms that enable children to recognize them and respond accordingly. In this study, 3 to 6 year old children living in Bushman communities in South Africa were shown a sequence of causally irrelevant actions that differed in the extent to which goal demotion was a feature. The children consistently replicated the causally irrelevant actions but when such actions were also fully goal demoted they were reproduced at significantly higher rates. These findings highlight how causal opacity and goal demotion work in tandem to demarcate actions as being ritualistic, and specifically, how goal demotion uniquely influences the reproduction of ritualistic actions.

*Keywords*: ritual; causal opacity; goal demotion; over-imitation; social learning, cultural transmission

Rituals bind individuals into groups, and are thought to have played a crucial role in the emergence of complex societies (Norenzayan et al., 2016; Whitehouse & Lanman, 2014). Until recently, the study of rituals has primarily been conducted by anthropologists using qualitative methodologies. This has made it difficult for those in the quantitative fields to establish robust generalizations about the causes and effects of ritual on social cognition and behavior (Rappaport, 1999; Rossano, 2012). The absence of such foundational knowledge represents a problem for understanding how rituals are acquired and understood throughout human development. If rituals play a role in the formation of groups and more complex societies, we must understand how (and when) children contribute to (or are influenced by) this process. Two candidate features of ritual that allow us to discern actions as non-ordinary are causal opacity and goal demotion. The aim of the current research was to investigate how these features of ritual influence young children's learning proclivities.

Rituals comprise conventional actions that feature repetition, redundancy, formality, and stereotypy, in which production of the process is prioritized over the achievement of the outcome (Legare & Souza, 2014; Sørensen, 2007). Causal opacity and goal demotion are a consequence of these features (Kapitány & Nielsen, 2015, 2017). Causal opacity is generated when actions are uninterpretable from the perspective of physical causality as the actions lack an intuitive or observable connecting relation between the specific action performed (e.g., synchronized dancing) and the desired outcome or effect (e.g., making it rain) (Legare & Souza, 2012, 2014; Sørensen,

2007; Whitehouse, 2012). Goal demotion refers to an observer's ability to infer and understand an actor's reason (e.g., goals or motivations) for producing a given action sequence (Boyer & Liénard, 2006; Kapitány & Nielsen, 2015, 2017; Schjoedt et al., 2013). The key distinction between causally irrelevant and goal demoted actions is that, in the former, it is unclear what an actor's actions achieve, whereas in the latter it is unclear why the actor is motivated to perform them. Take someone twirling a cloth around in a circular motion in the air several times, with no causally identifiable outcome resulting from the action, this would constitute a causally opaque action ("what effect does that action have?"). If they use the cloth to then scrub an apparently already clean table this would constitute a goal demoted action; The causality of the action is transparent (i.e., to clean the table) but the intention driving it is not (i.e., why is the actor doing it?). Notably, rituals tend to be both opaque and goal demoted, and as a result are rarely dissociated both practically, and in the literature.

When actions are ritualistic, the inability to attribute causal- and intentional-understanding increases until it is clear to the observer that such actions are being performed for reasons other than to satisfy an instrumental outcome. Prior research has found that adults treat objects subjected to such actions differently from objects subjected to ordinary action (Kapitány & Nielsen, 2015, 2017; Vohs, Wang, Gino, & Norton, 2013). However, no published study has directly or empirically explored how children interpret and respond to causally irrelevant *and* goal demoted actions.

There are multiple ways in which children show social and cognitive preparedness to adopt the ritualized behaviors of those around them (see Legare & Nielsen, 2015). According to a number of authors (Rossano, 2012; Wilks, Kapitány, & Nielsen, 2016) the most compelling example is 'overimitation', whereby children reliably copy visibly causally irrelevant actions modelled to them by an adult (Horner & Whiten, 2005; Nielsen, 2006) – notably these actions are typically causally opaque. For example, Nielsen and Tomaselli (2010) had an experimenter show children (aged 2 to 13 years) how to retrieve a toy from a closed box (e.g., by pushing open a trap door). Although the box could easily be opened by hand, the adult complicated the demonstration by swiping a miscellaneous object across the top of the box in a causally irrelevant manner, then using the same object to open the box. Children replicated the model's object use and incorporated the causally irrelevant actions into their response, and did so regardless of whether they lived in a large, industrialized Western city or in Bushman communities of the Kalahari Desert.

Extending this design, Nielsen and colleagues (2015) presented preschool children with actions that included opening a box and retrieving an object. In one condition, before the box was opened and the object retrieved, the sequence incorporated a redundant action (e.g., tapping the top of the box with a tool). In a contrasting condition, the redundant action was modelled *after* the object was retrieved from the box. Both conditions feature a causally irrelevant action, but only the latter possibly features goal demotion (as it is unclear why the experimenter would perform deliberate actions after the

afforded goal had been satisfied). Children reproduced the redundant actions at statistically similar rates across conditions. Whether the redundant action occurred before or after the goal of the sequence had been achieved, its reproduction was neither diminished nor increased. Actions in which goal demotion is emphasized thus appear to arouse similar levels of reproduction as actions in which it is not emphasized. However, the overall sequence was still associated with a goal, even if some redundant actions occurred after the goal had been satisfied. Does goal demotion cue conventional responses and arouse high fidelity reproduction if an action sequence is simply devoid of *any* afforded goal? And given the importance of contiguity in learning (Kushnir & Gopnik, 2007) is goal demotion a continuous dimension, such that as the contiguity of action and outcome declines, goal demotion increases?

To investigate this we presented children aged 3 to 6 years with versions of the task employed by Nielsen et al. (2015). Children were randomly assigned to one of four conditions. In a control 'Goal Apparent' condition, an adult modelled a sequence comprising a causally irrelevant action, a causally relevant action, and a second causally irrelevant action *before* retrieving a prize from inside a box. Here, the sequence features causally irrelevant actions, but as the action ultimately leads towards the satisfaction of a goal – a sticker is retrieved from inside a box – all actions may be interpreted as having been motivated in the service of that goal, and hence are goal apparent. This was contrasted with three experimental conditions in which the degree of goal demotion associated with the actions was altered. In a Goal Available Condition the second causally irrelevant action was

performed after the goal was realized. As the sticker had already been retrieved it is unclear why the second causally irrelevant action was performed, but it was nonetheless associated and contiguous with the goal (as it was performed as part of the larger action sequence that included a goal). In a Goal Unclear Condition all actions were performed as part of a sequence, but once the box was opened the sticker was not retrieved. The apparent goal of the sequence (retrieving the sticker) was never realized, and the actions and the afforded outcome are not contiguous. Finally, in a No Goal Condition the sequence was modelled but there was no reward in the box. This last condition features complete goal demotion – there is no affordance or satisfaction of a causal sequence of events that brings about, or is justified by, an outcome: Nor is any degree of contiguity possible. We thus anticipated that children in this condition would replicate the irrelevant actions at the highest rate. Because of the exploratory nature of this work we made no other direct predictions.

Further, it has recently been argued that the dearth of systematic research outside Western cultural contexts presents a major impediment to theoretical progress in the developmental sciences (Legare & Harris, 2016; Nielsen & Haun, 2016). For this reason we deliberately conducted our research with children from Bushman communities in Southern Africa; a decision representing a meaningful departure from the otherwise limited and homogenous status quo (Nielsen, Haun, Kärtner, & Legare, 2017).

## Method

*Participants*

All children in the target age-range at the communities we visited were invited to participate. Our aim was to test as many as were available and willing. Overall cell sizes were thus small, but these are nonetheless in line with previous studies conducted with these populations (Nielsen, Mushin, Tomaselli, & Whiten, 2014; Nielsen, Tomaselli, Mushin, & Whiten, 2014) and with comparable cross-cultural social learning research (e.g., Berl & Hewlett, 2015). Sixty-five Bushman children (33 male; 32 female) thus participated in this experiment, but 10 were excluded for a variety of reasons (3 for experimenter error; 1 for not engaging with the apparatus; 4 because of interference either from other children or a carer; and 2 because of uncertainty surrounding their age). Those included in the final sample were aged between 3 and 6 years (median age=5 years, mode=5 years). Of the final 55 children (27 male, 28 female), 31 were living in Platfontein, an immigrant settlement in a rural area 15 kilometers west of Kimberley, the provincial capital of South Africa's Northern Cape. All children were members of either the !Xun or Khwe clans (for more detail see den Hertog, 2013; Nielsen, Mushin, et al., 2014). An additional 24 children were included from 3 different ǂKhomani settlements in the region of the Kgalagadi Transfrontier Park, 600kms north-west of Platfontein. These settlements sit on land awarded to the ǂKhomani San community as an outcome of a restitution claim settled in 1999 (Grant, 2011). Prior to this claim the violence and dislocation wrought by

colonialism and apartheid resulted in the dispersion of the ǂKhomani, their language, and their cultural practices (Tomaselli, 2005). Though advances have been and are being made, the children on these settlements, as with those from Platfontein, live in sub-economic conditions.

Though hunting and gathering occasionally and sporadically take place in these communities, commodities are primarily acquired through commercial and private trade (even though these groups are economically disadvantaged compared to those living in cities and more established communities). Our participants and their families are exposed to modern society and sit both inside and outside of it, balancing contemporary and traditional values and ways of life, while dealing with the social and economic disadvantages that are a common experience of the world's indigenous peoples (Tomaselli, 2005). These children and the environments in which they develop thus contrast starkly with those who typically participate in child development research (Nielsen et al., 2017). All children were randomly allocated to one of four experimental conditions described below and received a small gift for participating (i.e., an item of clothing or small toy). The second author has been working in these communities for over 15 years and is well known to those living there. He was present for all testing. The first author conducted the testing which commenced after children had spent several minutes playing warm-up games unrelated to the experiment.

*Apparatus*

Children were presented with two distinct puzzle boxes: A *Light Blue* box (13cm x 17cm x 13cm) that could be opened by lifting a metal hoop upwards and a *Plain Wood* box (30cm x 19cm x 10cm), mounted on two wooden supports, that could be opened by pushing the lid up via two small metal loops fixed to the front. The *Light Blue* box was presented with a 19cm wooden dowel with a black handle and the *Plain Wood* box with a 16cm yellow drumstick with rubber ball on one end and small hook on the other. Stickers were drawn randomly from a large pool and placed inside boxes prior to beginning the experiment, where appropriate. We did not directly index the value children placed on the stickers. However, stickers constitute a resource they rarely have access to and the children typically expressed delight when given them as rewards. Further, as children have been shown to prioritize imitating for a small reward over engaging in individual learning to obtain a large reward (Turner, Giraldeau, & Flynn, 2017) there is little foundation to expect the direction of this value to overly impact children's responses.

*Procedure*

Data were collected in June 2014. Children were tested either inside a community building or dwelling, or outside sitting on the ground, by the side of a house or small community building (see Figure 1). Testing was conducted in such a way as to ensure that children could not observe the experiment prior to their participation. Children were ushered by a familiar member of the local community, who also remained throughout the testing

period. An unobtrusively placed camera recorded all test sessions for later coding. Children were randomly allocated to one of the following four conditions (for a summary see Table 1). We aimed to test all children in the communities we visited, stopping only when no more children were available (numbers for each condition are indicated below).

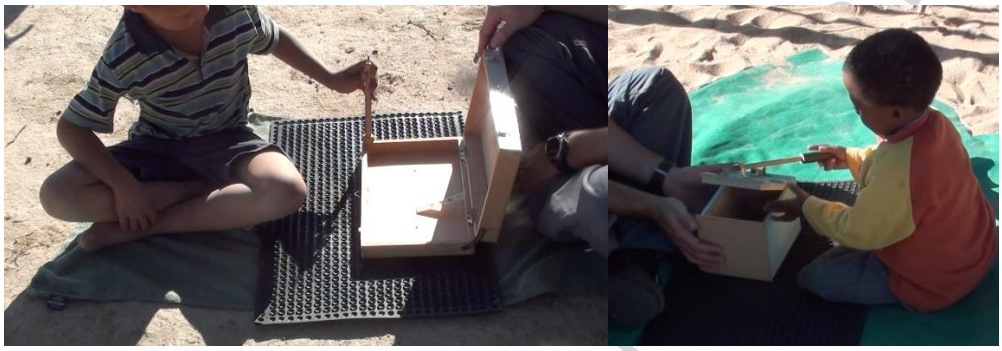

*Figure 1*. Child reproducing the second Causally Irrelevant Action associated with the Plain Wood box (LHS) and the Causally Relevant Action associated with the Blue box (RHS).

*Goal Apparent Condition* (n=13). The experimenter presented the child with the Light Blue box, and picked up the dowel tool. They scraped the tool across the top of the box from front to back three times (Causally Irrelevant Action 1), then placed it under the metal hoop, pulling it upwards to open the box (Causally Relevant Action 1). The dowel was then tapped three times on the side of the box (Causally Irrelevant Action 2) and the sticker retrieved by hand (Causally Relevant Action 2). This sequence was repeated, with the sticker replaced behind the experimenter each time (i.e., out of the child's direct sight) and then the box and tool presented to the child. No instructions

were given. Testing concluded after the child satisfied the apparent goal, or 60 seconds had elapsed. The box was then removed.

The experimenter then presented the Plain Wood box and the associated drumstick. The drumstick was placed ball end down and then tipped back and forth three times, using the ball end as a fulcrum (Causally Irrelevant Action 1). The drumstick was then held by the ball and the hook used to grip one of the metal loops, pulling upwards so as to open the box (Causally Relevant Action 1). The stick was then tapped three times on a side of the box (Causally Irrelevant Action 2) and the sticker retrieved by hand (Causally Relevant Action 2). This sequence was repeated, then the box and tool were presented to the child. Again, no instructions were given and the child was given 60 seconds to respond. Box order (Light Blue or Wood first) was counterbalanced across children.

*Goal Available Condition* (n=14). This was identical to the *Goal Apparent Condition* except the sticker was retrieved after the box was opened, placed back in the box and then the second causally irrelevant action was demonstrated.

*Goal Unclear Condition* (n=14). This was identical to the *Goal Apparent Condition* except that the sticker was not retrieved. When the box was opened the sticker was present but the experimenter did not deliberately gaze at it or place a pause in the action sequence to acknowledge it. This meant that the action sequence afforded a goal, but the goal was never explicitly made clear.

*No Goal Condition* (n=14). This was identical to the *Goal Apparent Condition* except there was no sticker inside the box. The actions never afforded the observer a goal or motive for the actions.

Table 1. *Summary of action sequences and goals by condition.*

| **Condition** | **Key Differences** |
|---|---|
| Goal Apparent<br>*The apparent goal of the action sequence is to retrieve the sticker.* | Causally Irrelevant Action 1<br>Causally Relevant Action 1 (box opens)<br>Causally Irrelevant Action 2<br>Sticker Retrieved |
| Goal Available<br>*The goal of the action sequence is available and demonstrated to the participant.* | Causally Irrelevant Action 1<br>Causally Relevant Action 1 (box opens)<br>Sticker Retrieved and then Replaced<br>Causally Irrelevant Action 2 |
| Goal Unclear<br>*The afforded goal (to retrieve the sticker) is ignored, and thus, is unclear.* | Causally Irrelevant Action 1<br>Causally Relevant Action 1 (box opens)<br>Causally Irrelevant Action 2<br>(Sticker not interacted with, remains untouched) |
| No Goal<br>*The box contains no object, and thus, affords no obvious goal.* | Causally Irrelevant Action 1<br>Causally Relevant Action 1 (box opens)<br>Causally Irrelevant Action 2 |

*Coding*

The behavior of participants was coded from videos recorded during testing. For each condition children were scored for: (i) the number of Causally Irrelevant actions produced (Causally Irrelevant Actions 1 and 2

separately); and (ii) whether or not the Causally Relevant actions were produced (as they have a functional purpose they are not the focus of this research). Children were free to exhibit the modelled actions as much as they wanted. A second coder, blind to the study and hypotheses, was presented with video from fifteen randomly selected participants (27% of trials). According to intraclass correlation coefficients, inter-rater reliability was high for all dependent variables: Causally Irrelevant Actions 1 = .97, $p < .001$; Causally Irrelevant Actions 2 = .99, $p < .001$; and Causally Relevant Actions = 1.00 $p < .001$.

## Results

Preliminary analyses failed to detect any condition-dependent effects of sex, age or community. These variables are not considered further. Across all conditions only five children did not perform the causally relevant act (as demonstrated) to open the blue box and three did not open the wooden box. These omissions were not systemic across conditions, and are indicative of near-ceiling performance among participants. As such, this variable is not considered further. Given the small cell sizes and non-normally distributed data all analyses were conducted using non-parametric tests.

Figure 2 shows the mean number of times the first and second causally irrelevant actions were reproduced across conditions. According to a Kruskal-Wallis test, the first causally irrelevant action was not performed at significantly different rates across conditions, $\chi^2(3, N = 55) = 6.83$, $p = .08$. In contrast, we observed a significant difference in the rates of reproduction on

the second causally irrelevant action, $\chi^2(3, N = 55) = 14.87$, $p = .002$. Mann-Whitney post-hoc comparisons revealed that children in the No Goal condition produced more actions than children in the Goal Apparent ($p.<.001$), Goal Available ($p.=.002$) and Goal Unclear ($p.=.027$) Conditions. No other differences were observed.

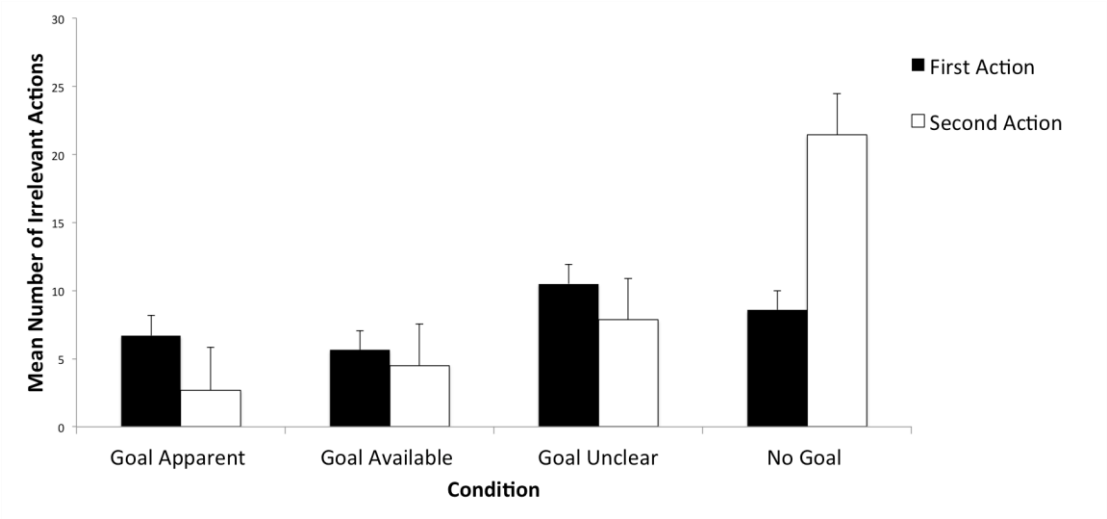


*Figure 2*. Children's mean imitation of the first and second causally irrelevant actions (error bars indicate standard errors).

Children were modelled each irrelevant action three times on each box, meaning there were six of the first causally irrelevant actions modelled and six of the second causally irrelevant actions modelled. As already outlined, there were marked differences in children's responses between conditions. For example, only one child in the Goal Apparent condition copied the second irrelevant actions more than 6 times, whereas 10 children did so in the No Goal condition. There were also notable within condition differences. For example, in the Goal Unclear condition, 5 children did not copy the second irrelevant actions at all whereas 3 children did so more than 10 times. Highlighting these differences, Figure 3 presents the frequency with which each child produced the first and second irrelevant actions across conditions.

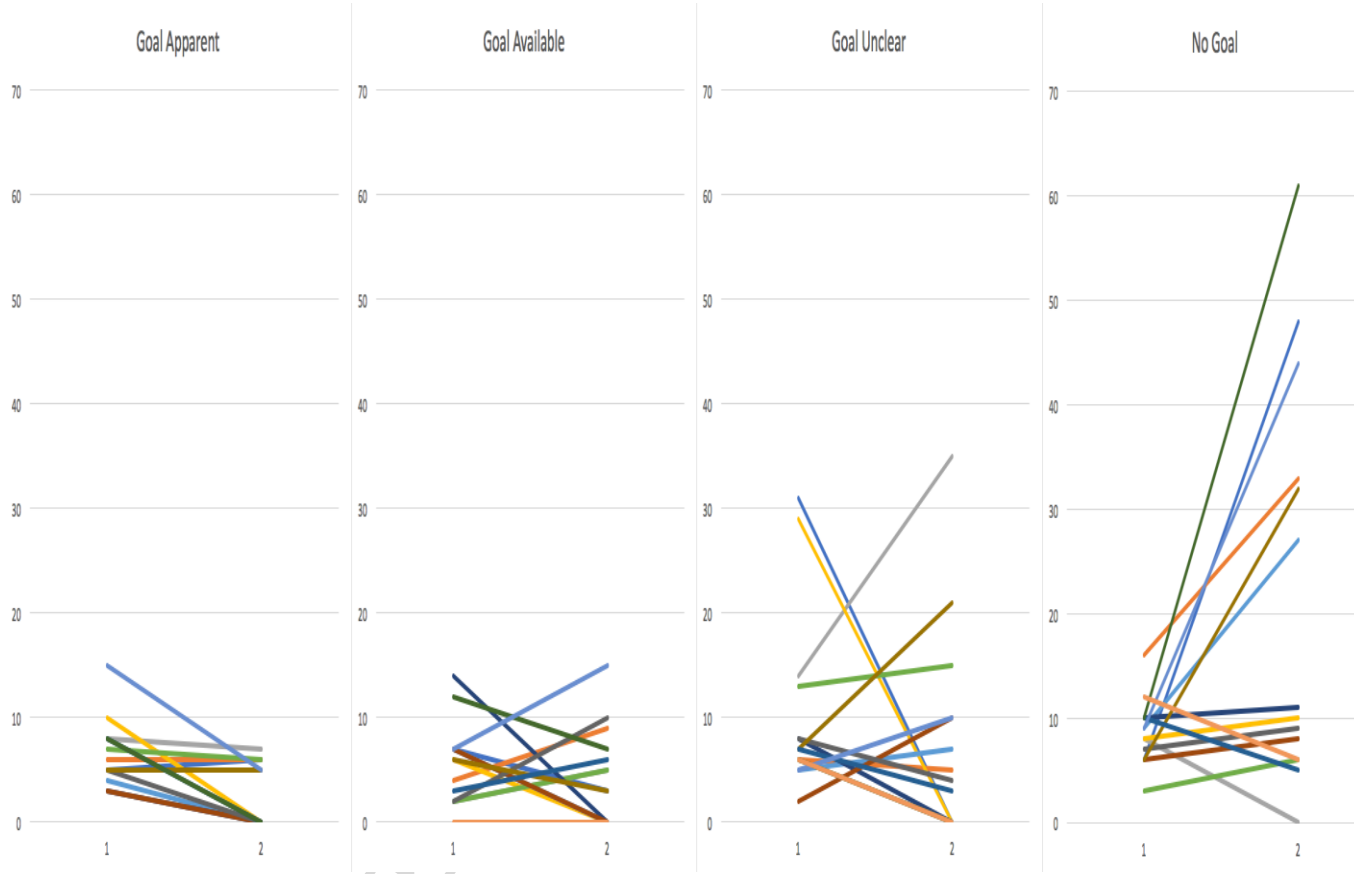


*Figure 3*. Frequency of each child's imitation of the first (1) and second (2) causally irrelevant actions across conditions.

## Discussion

From the benign to the life altering, recurring daily or annually, engaging in rituals is a significant and ubiquitous aspect of human behavior. To become valued, active participants of their cultural in-group children must be able to identify rituals, and recognize what it is about them that is important to learn and replicate. The research presented here suggests that

young children are sensitive to causal opacity and goal demotion as cues to help them identify culturally bound behaviors, showing that, as expected, when actions are fully goal demoted they are repeated at much higher rates than when there is the appearance of a discernable goal linked to the actions.

As has been previously demonstrated (Nielsen et al., 2015) and extended here to a new cultural group, children reproduce modelled actions if they are associated with a clear functional outcome regardless of where that outcome is placed in the sequence. Children who saw causally irrelevant actions demonstrated *after* the afforded goal of the sequence had been satisfied reproduced those actions at similar rates to children who saw the same causally irrelevant actions immediately *before* the goal was satisfied. This suggests that, where there is an afforded goal, any action in a modelled sequence can be treated as if it is associated with the goal, regardless of how implausible that might be (see also Schleihauf, Graetz, Pauen, & Hoehl, 2017).

Nevertheless, when a sequence did not afford inference to a goal children not only copied causally irrelevant actions, but did so with greater frequency than was modelled. This effect is most stark for the second causally irrelevant action, in which children in the No Goal condition reproduced, on average, three times as many redundant actions as were modelled. We maintain that this condition signals that the behavior performed is ritualistic because the actions are causally irrelevant and the inference to an intention or goal for the actions performed is absent. It is important to note that in the three conditions where a sticker was present, trials were terminated when the sticker was retrieved. It is thus possible that had children been left to

continue they might have opted to act out the second irrelevant action to levels equivalent to those in the No Goal condition. Given prior evidence that children will cease imitating when they have achieved what they interpret to be the goal of a demonstrated object-directed action (e.g., Loucks & Meltzoff, 2013), we consider this unlikely.

The findings reported here shed light on now classic studies of social learning in which children's imitation of specific gestural actions was shown to be more accurate when there was no apparent goal to them (such as touching dots on a table; Gattis, Bekkering, & Wohlschlager, 2002). Removing the goal has been previously interpreted as taking away a layer of complexity in the demonstrated sequence, allowing children to focus instead on the specific movements modelled. The current results suggest an alternative: In the absence of a goal state the actions are interpreted within a ritualistic framework and emphasis is hence placed on more precise reproduction. It is also possible that children process modelled actions that aren't associated with a tangible goal as invitations to engage in something like a "do as I do/copying game" activity. However, such a perspective, in the context of the current experiment, fails to explain the high rate of replication in the No Goal condition.

In some rituals, an action should be repeated a prescribed number of times – no more and no less. As it is the case that when an action cannot be identified as serving a particular causal relationship or a specific motivation, there is no better or best way to perform it. Children in the No Goal condition could thus be seen as violating such a rule through their excess reproduction

of the second irrelevant action. That said, a cautionary approach to the problem would be to over-perform, rather than under-perform, when uncertain (a la Wood et al., 2016). What the current data indicate is that in young children precise frequency copying likely depends on explicit instruction and is not a default approach. Research is now needed to detail when children might choose to reproduce a modelled action precisely the same number of times as modelled and when (and why) they might, as in the current experiment, choose to copy at a higher frequency.

The reactions of children in the Goal Unclear condition (in which the sticker was in the box, but was not interacted with) was not statistically different from the reactions of children in the Goal Apparent and Goal Available conditions. Children in this condition could see a potential reason for the demonstrated actions - retrieving the sticker initially hidden inside the boxes - but any surety about the goal would have been corrupted by the adult's failure to satisfy this affordance. As noted, whereas three children in this condition replicated the second causally irrelevant actions 10 times or more, five children did not reproduce them at all. This suggests that for some children the action was seen in a ritualistic light, while for others it was not (see Figure 3). This surprising finding warrants future exploration, along with targeted research aimed at identifying the individual differences that lead some children to imitate with high frequency repetition and others not (e.g., as evident in the No Goal condition).

It has been argued that causal opacity and goal demotion are common qualities of many rituals, and that these features allow observers to identify

an action sequence as a ritual rather than as an ordinary alternative (Nielbo & Sørensen, 2011; Sørensen & Nielbo, 2013), thus cuing different behavioral and cognitive responses (Kapitány & Nielsen, 2017). However, while there is now a large corpus of research charting children's reactions to causally opaque actions, there is scant investigation of goal demotion and, to the best of our knowledge, no prior study that has directly set out to chart this in young children. In this context it is important to note we do not consider that these qualities are easily disentangled. Indeed, our perspective is that they most commonly co-occur. In the current study, each of the irrelevant actions was causally opaque. What we varied was the level of goal information associated with them. Our contention is that causally transparent actions (that do not have any historical and exegetical associations) will be interpreted as functional, whereas causally opaque actions prime the ritual stance, an interpretation increasingly likely to be made as goal information becomes increasingly demoted.

Why might children show this inclination to copy ritualistic actions? We believe the answer is twofold. First, human survival depends on others and as a consequence the capacity for ingratiating oneself to one's cultural in-group is of paramount importance. Rituals are a means of signaling group identification in this way. Second, over 1.5 million years ago our hominin ancestors began the Acheulean lithic complex with its characteristic handaxes and cleavers (Beyene et al., 2013). It is argued that the propagation of this industry depended on the emergence of a mind prone to overimitate (Nielsen, 2012; Rossano, 2017; Shipton & Nielsen, 2015) and that once established such

a mind readily lent itself to exaptation in the form of ritual behavior (Rossano, 2012; Wilks et al., 2016). Early sensitivity to detect and willingness to reproduce ritual actions is thus likely to have been subject to significant evolutionary pressure (Nielsen, under review). Moreover, while the present study (and much of the overimitation literature) examines ritualistic behaviour directed toward objects, it is the case that a great deal of ritualistic action is performed in the service of group identification and group bonding (Wen, Herrmann, & Legare, 2016; Whitehouse, 2004). Thus, a child who demonstrates willingness to learn, adopt, and replicate group-relevant ritualistic practices may be perceived as an increasingly competent, if immature, group member (Clegg & Legare, 2016; Clegg, Wen, & Legare, 2017). That we observe such a tendency under somewhat impoverished social circumstances is support for our argument that two of the key, foundational features, of ritual cognition are causal opacity and goal demotion.

There are many social and cognitive attributes that mark our species as strikingly different to those we share the planet with, and engaging in ritual behavior should be considered among the most prominent. In lacking clear and obvious causal outcomes, ritualized behaviors present a raft of challenges to a young mind trying to make sense of the world. At the same time as they are presented with the challenges of mastering use of a host of objects children must simultaneously make sense of a myriad of behaviors that appear not to achieve any immediate, tangible outcome yet are treated as important by those who practice them. Here we establish for the first time how causal opacity and goal demotion can function in conjunction with each

other to yield unique markers that actions should be processed as ritualistic, and as a result reproduced with a frequency that differs starkly from actions that do not share these features. This provides new and unique insight into what makes us who we are.

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