Rituals to Remember?

The following is description of a manuscript in the final stages of drafting prior to submission. Rohan invites you to read the following, and consider attending to the preprint in order to help improve the research with constructive feedback.

In 2015 I listened to an interview[1] with Dr. Freya Harrison, a chemist at The University of Nottingham, who had recreated a 1100 year old medicine for the treatment of a sty[2]. Much to the surprise of her whole research team, not only was the medicine effective, it was effective against MRSA, a particularly problematic strain of treatment-resistant bacteria. Just imagine how it felt when this worked:

"Make an eyesalve against a wen [a sty]: take equal amounts of cropleac [a type of onion] and garlic, pound well together, take equal amounts of wine and oxgall, mix with the alliums, put this in a brass vessel, let stand for nine nights in the brass vessel, wring through a cloth and clarify well, put in a horn and at night apply to the eye with a feather; the best medicine."

Would you have wagered this recipe would produce an effective medicine? Or rather, would you have expected a placebo response and a curious odour? In her resulting article, Dr. Harrison claimed we shouldn't think of these ancient people as particularly 'backward or superstitious'; someone might believe that, if a procedure required the recitation of 15 Hail Marys then the incantation was playing a divine role, but in reality (and unbeknownst to the actor), it may simply have been a reliable way to measure a 2-minute interval in an era without timepieces. I personally think this is quite a generous interpretation, since each ritual action necessarily needs to be independently justified by a hidden mechanism, but it is certainly an idea with merit.

What if the rituals were playing an important role (and possibly even the same role)? Having spent an inordinate amount of time over the last few years thinking about ritual and cultural evolution, an alternative occurred to me.

Medieval medical procedures initially captured my attention because it must necessarily have been the case that for most of human history, knowledge of how to produce things - medicines, drugs, clothes, tools, buildings - had to be transmitted without the aid of an external reference. This knowledge existed, variously distributed, inside human heads. And as time passed, both historically and over the course of one's life, those heads only became more full. How efficient was it to remember things that were instrumentally unimportant, and then to repeatedly perform those things? Surely even a gentle selection pressure for simpler processes and fewer ingredients would result in - over time and repeated iterations - greater efficiency? Moreover, I assumed that when an ostensibly instrumental action sequence was primarily composed of causally opaque, confusing, and unfamiliar actions, then a naive observer would be overwhelmed, and recall would be impaired. If you've ever tried to teach a child how to tie their shoelaces, you know what I'm talking about.

And so, I wondered, might rituals be doing something that facilitates their own apparent tenacity? We, as humans, like to be able to predict our environments. We're constantly scanning, tracking, and predicting what people will do, and how they are trying to do it. And yet, rituals tend to violate the prediction we make about others' intentions (Why did you do that?) and our understanding of causality (How does that work?). Rituals, by violating our expectations, produce 'cognitive capture': they arrest our attention, and motivate us to restore an understanding of the world that is predictable. Perhaps unsurprisingly, we tend to better remember things that occur at the exact time and place when our attention is arrested, focused, and motivated. If rituals can do all this, is it possible that their inclusion in complicated behavioral sequences benefits

the re-production of behaviors and technology? Were rituals helping people to learn new behaviors?

And so I decided to run a memory experiment. I'd show a bunch of people a complicated, ostensibly important, and instrumental action sequences and ask them to describe their memories. I'd vary the proportion of rituals they observed within each sequence in order to quantify whether some small proportion of ritualized action improved recall. It also stood to reason that a high proportion would overwhelm people, which would harm recall (consider again the child learning to tie their shoes). And since I was confident (and motivated by a $1,000,000 challenge) I pre-registered everything[3].

In the beginning I was sure that, if this phenomenon were real, it would be large and interesting, and not simply an effect only observable at the statistical level. Nonetheless, I wanted two measurements from each participant. But given the nature of the research question, it was obvious that I couldn't show participants variations of the same thing twice, as the order and carry-over effects would swamp the anticipated phenomenon. And so I created two 'template' sequences: both ostensibly modelled on 'ancient medicines'. Both of these sequences were of equal duration (2 minutes), and were made up of 6 behavioral units of action (i.e., mixing things in a bowl), while each behavioral

unit was made up of a number of gestures (i.e., put the salt in the bowl, put the garlic in the bowl, mix together). While the template sequences were similar, they were distinct and complicated enough that there would be no carry-over or order-effects.

Having created these template sequences I then created 6 additional variations of each, where I manipulated the number of embedded ritualized actions. Each variation involved disrupting one of the normal, instrumental actions, so that it was repetitive, redundant, and/or stereotyped, and most importantly, completely causally opaque to the observer. An instrumental action, for example, involved putting two things into a jar, putting on a lid, holding the jar, and shaking them together; the ritualized variation involved putting the same two things into a jar, putting on the lid, putting the jar on the table, and performing a shaking-motion with my hands in the air above. This ritualized action shared the same duration, ingredients, and motor actions, and yet action-structure was disrupted such that determining the causal relationship between the action and the expected outcome was impossible.

Each subsequent variation changed one of the 6 behaviors from an instrumental act into a ritualized act. Thus, the 'template' sequences were fully instrumental (6 instrumental actions), while the
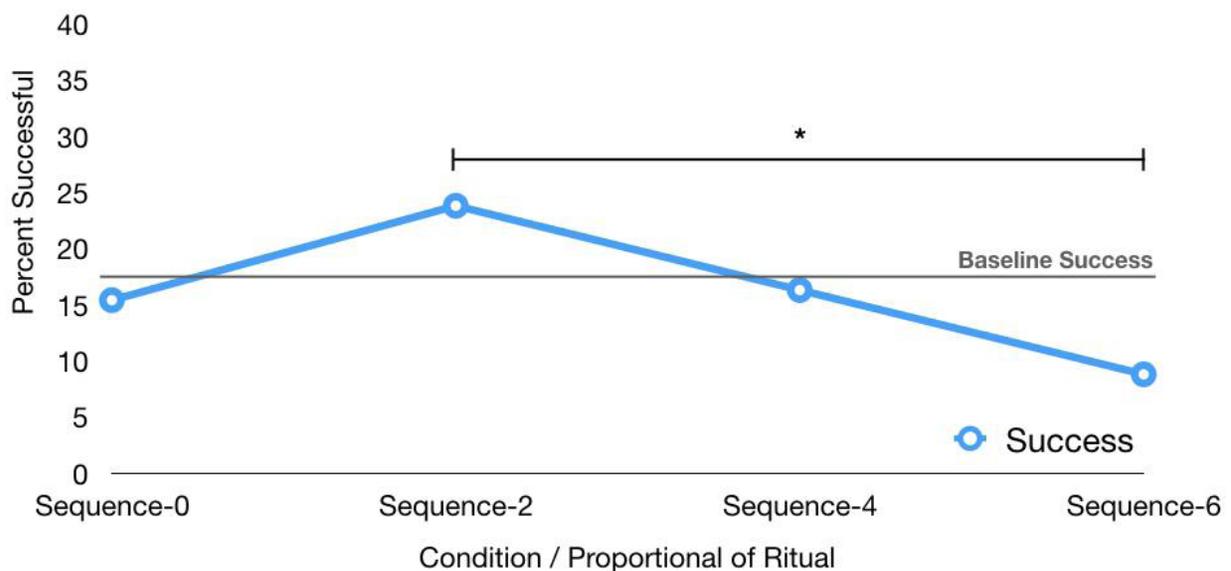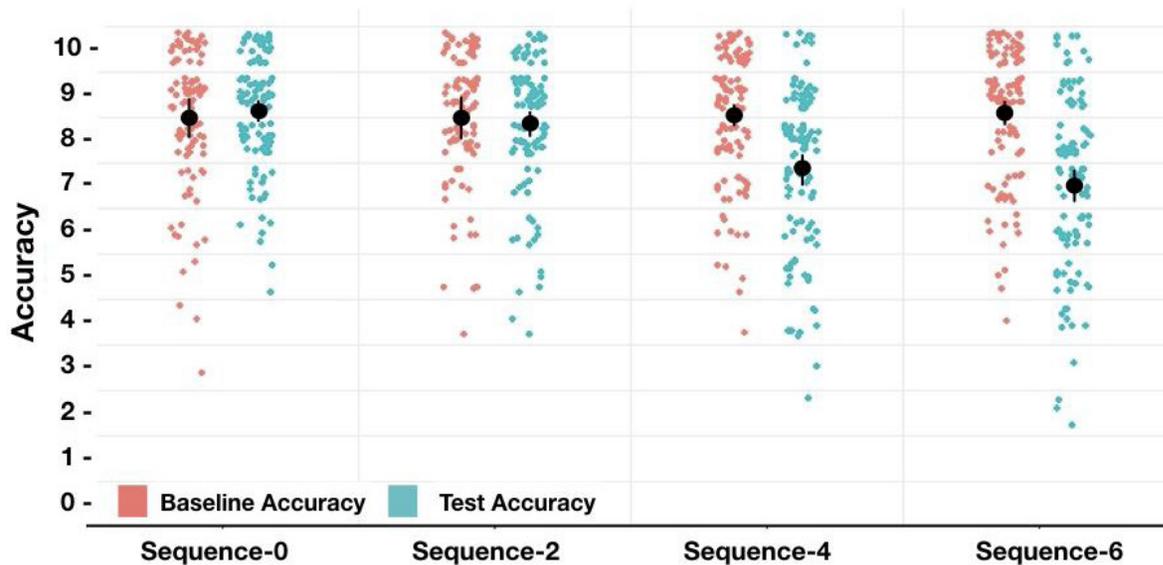
Test Condition

first variation of each had 1 ritualized actions and 5 instrumental, the second variation had 2 ritualized actions and 4 instrumental, and so on, until each of the 6 gestures had been ritualized.

Next came the question of measurement. The first dependent variable was a liberal measure of accuracy / discrimination. Could the participant identify things that had actually happened? Here, I ignored anything that was falsely reported as present. The second measure was a binary score that determined whether or not what the participant reported only correct statements, and in the correct order. That is, could they reproduce the intended outcome without error? Here I was attempting to approximate an ecologically valid measure of novel learning. For context, consider how accurate you need to be to bake a soufflé or tie a Windsor knot. Being 95% correct on such a procedure is not sufficient - correct reproduction requires the process to be just so. Finally, I wanted a measure of 'detail'. Initially I pre-registered a coding rubric, but it quickly became apparent that this was unwieldy and excessively time consuming (and unlikely to do what I had hoped). I opted then, simply, for a word count (a hopefully defensible decision in light of my deviation from the pre-registration). If it were

the case that rituals could aid memory for complex sequences, then a liberal measure of 'accuracy', a conservative measures of 'success', and an objective measure of 'detail' might uncover the hypothesized effect.

I conducted two experiments. The first experiment demonstrated the validity of the stimuli, and showed that participants reported diminishing confidence in the accuracy of their responses as the proportion of rituals increased. However, on my dependent measures, predicted and suggestive patterns emerged, but were not significant. That said, we believe these were the result of a few 'inelegant design decisions', rather than evidence of the absence of the effect. For this reason I direct the reader to the preprint for further information, and will hereafter focus on study 2.

In study 2, all participants saw one fully instrumental sequence (one of the master-templates), and one (of four) randomly selected 'test' videos from the other template-sequence. The 'test' videos were sequence-0 (the alternative fully instrumental master-template), sequence-2 (2 rituals, 4 instrumental actions), sequence-4, and sequence-6. We recruited just over 400 participants from mTurk.

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(This number, based on simulation data, indicated that 100 observations per cell was sufficient to reliably detect a difference as small as 3% between contiguous conditions). Accuracy was operationalized as a set of 10 true/false questions (where each condition had the same questions, yet the correct answer depended on the condition), and 'success' was operationalized in a task that required the participants to perfectly order 12 randomly-presented true statements about the video. While the 'detail' measure was a simple word count in response to a free-recall description task.

So, what did I find? The very pretty scatter plot shows participants scores on the accuracy task. The red points are participants' scores on the fully instrumental baseline, and the teal points are their matched scores on the test sequence. It is clear that accuracy drops when the proportion of rituals is high, though it's not clear that there's any boost (or bust) when low.

Encouragingly, when participants were asked to order 12 random-presented true statements in correct order, the condition with the highest proportion was sequence-2, and the lowest was sequence-6. Specifically, in the test condition, those who saw sequence-2 were over 3 times more likely to be successful than those who saw sequence-6.

Finally, we observed that word count increased in a linear manner as the proportion of rituals increased. Moreover, a participants' confidence in their own recall significantly and linearly declined as the proportion of ritualized actions increased.

So what does this mean for the hypothesis that causally opaque rituals may help people learn new behavior? It seems quite clear that the cost of ritualized actions is not trivial, and that they do appear to harm recall when present in high proportions. But what of the idea that they are helpful at low proportions? Well, the data are suggestive, but in no way conclusive. Study 1 and study 2 both show highly similar patterns, but only study 2 had anything statistical to say on the matter (though this is but one experiment on a novel and speculative hypothesis). The present data also have very little to say on the historical frequency of such things. Humans are, of course, prolific imitators, but they are not entirely injudicious either. What I can say is that these kinds of rituals are highly common, and appear to arouse specific cognitive responses when observed. Though, as I outline in the manuscript, acknowledging that ritualized actions appear to have (if nothing else) a cumulative negative impact on recall has implications for quite well known theories of ritual cognition, as well our understanding of social learning strategies. While the question of whether or not rituals provide some benefit at low frequencies is unanswered, it cannot yet be ruled out. Personally, I hope to continue research on this, to identify exactly how cognitively costly such rituals are.

Here I'll conclude with a small thought experiment: Recall, as best you can, the recipe provided at the top of the article. It features 11 steps/ingredients, and some degree of ritualization. Take a moment to mentally recreate it…. Then identify the proportion of apparently ritualistic acts, and consider, as best you can, whether or not sequence would be easier, or more difficult, to remember without them. □

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REFERENCES

1) See radiolab.org/story/best-medicine/

2) An infection of the eyelash follicle

3) See cos.io/prereg

4) This research has been conducted with input from Mark Nielsen, Chris Kavanagh, and Harvey Whitehouse.

5) The pre-print of this article is available here. Alternatively, follow Rohan on twitter (@psycasm) where he will announce the release of the preprint, and also RT clever and/or interesting things other people say.