and the bifocal stance that allows flexible switching between both? We think that light can be shed on this question through an investigation of how it may have emerged in our hominid ancestors. Following Sterelny's (2012) account of the evolution of human cognition, which emphasizes feedback loops between learning, environmental scaffolding, and cooperative foraging, we maintain that the evolution of the bifocal stance should be understood in the context of cooperative foraging. This type of social arrangement creates unique pressures and opportunities that can support the development of both types of cultural learning, as well as the ability to move between them as appropriate.

Successful cooperative foraging can provide a surplus under which investments into cultural learning can be sustained before they inevitably have to pay off. Elsewhere, one of us has argued that it is in this context that we can understand the evolution of resolve as a means to enable interpersonal exchange (Veit & Spurrett, 2021). Here too, the value of the instrumental stance increases. With sharing and trading becoming a central feature of the lives of our early hominid ancestors, there was a need to evolve both motivation and attention towards keeping track of the instrumental value of different actions, which could be scaffolded to promote a greater awareness of the instrumental value of both behavioural innovations and other people's actions. With more complex foraging methods, the value of learning and innovation also increases, further expanding the human foraging niche. However, importantly, this also has the potential to have facilitated the development of the ritual stance. Human societies are unique in the degree of reliance of individuals on the community. Under these conditions, the risks from social ostracism are much higher, as it would be near impossible for an individual to survive in isolation. As the authors have demonstrated, the salience or threat of social ostracism seems to lead into the ritual stance, where copying fidelity increases. In general, as the rewards of social cohesion increase, along with the costs of ostracism, we should expect to see the elaboration of the ritual stance; and this is precisely what occurs with the rise of cooperative foraging.

Cultural learning is far more complex in humans than any other species, seemingly responsible for many of the features we take to be unique about human cognition and societies. Although other animals, particularly some nonhuman primates, show some forms of social learning and cultural transmission, right now it appears that only humans are capable of the high-fidelity copying that arises from the ritual stance, and of moving flexibly between the different types of learning as need suits. We suggest that it is through the emergence of cooperative foraging, and the unique selective environment thus created, that the bifocal stance will have truly come into its own, creating feedback loops that have led to its current form.

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Representational exchange in social learning: Blurring the lines between the ritual and instrumental

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Abstract

We propose that human social learning is subject to a trade-off between the cost of performing a computation and the flexibility of its outputs. Viewing social learning through this lens sheds light on cases that seem to violate bifocal stance theory (BST) – such as high-fidelity imitation in instrumental action – and provides a mechanism by which causal insight can be bootstrapped from imitation of cultural practices.

According to bifocal stance theory (BST), how faithfully someone imitates depends on their goals. We copy actions faithfully to affiliate with others or to highlight our membership in a group (the "ritual stance"), but selectively copy only what is necessary to achieve instrumental goals (the "instrumental stance"). We agree that social learning can serve both affiliative and instrumental ends. However, we disagree that high-fidelity copying is necessarily triggered by non-instrumental goals. Humans can perform a variety of computations to learn from others, from faithfully copying others' actions to inferring the values and beliefs that caused them. Collectively, these computations trade off the cost of performing the computation against the flexibility and compositionality of its outputs. Understanding social learning through the lens of this trade-off can guide theorizing about when high-fidelity imitation and mentalizing may be deployed toward the same goal, and provides a mechanism by which causal insight can be bootstrapped from faithfully transmitted cultural practices.

A general principle of intelligent behavior is to use simple methods whenever possible and more complex strategies when necessary. An emerging framework has framed the arbitration between simple and complex strategies as a resource-rational trade-off (Lieder & Griffiths, 2020). Much like a thrifty shopper or an efficient long-distance runner, adaptive organisms should not only maximize rewards, but also account for the cognitive costs of different strategies. While resource-rational adaptations have been widely studied in the context of individual decision making (Kool, Gershman, & Cushman, 2018; Shenhav et al., 2017), we propose that a similar trade-off exists in social learning (Wu, Vélez, & Cushman, 2022).

To illustrate this trade-off, suppose you are watching your friend bake baguettes. As she pops the loaves into the oven, she pours boiling water into a skillet on the bottom rack. There are several ways that you could learn from this observation. First, you could directly imitate this action the next time you bake baguettes. This may quickly improve your technique, at the cost of flexibility: You may continue copying this action even when it is unnecessary or maladaptive. Alternatively, you could try to infer *why* she performed that action. For example, you could infer she used the boiling water to create steam, because steam gives bread a crunchy crust. Inferring the goals and beliefs driving your friend's actions is more costly than simply copying her, but it affords increased flexibility. The next time you bake bread yourself, you could use this insight to find alternative solutions to the same goal (e.g., by spraying water on the loaves) and to skip it when it is not needed (e.g., when baking soft, chewy breads).

What distinguishes these possibilities is not the observer's goal, but whether the benefits outweigh the computational costs. This trade-off helps identify cases where high-fidelity imitation is not only possible, but even preferable to mentalizing in instrumental contexts. If you are baking bread for the first time, or operating a complex and expensive MRI machine, you will likely maximize your rewards (and avoid catastrophic costs) by strictly following procedure.

Just as high-fidelity imitation can sometimes be beneficial to instrumental action, this computational trade-off can also guide theorizing about contexts where strategic innovation may be deployed in ritual. For example, medieval charms often required certain words to be invoked verbatim, but allowed ingredient substitutions (Luft, 2020). One charm for curing rabid dogs involved buttering a slice of barley bread ("or if you cannot get that [type of bread], take another") and writing ritual words on it before feeding it to the dog (Leach, 2022). It is possible these deviations from ritual were guided by intuitive theories about which aspects were causally relevant – perhaps the charm depends on the words, but not on the type of bread on which they are written. Indeed, recent work suggests that modern adults' judgments about magic, such as the difficulty of a charm, are governed by intuitive theories of how the real world works (Lewry, Curtis, Vasilyeva, Xu, & Griffiths, 2021; McCoy & Ullman, 2019). While we agree that rituals serve an important affiliative function, these examples raise the possibility that rituals have their own causal logic and may allow a greater degree of behavioral flexibility than accounted for in BST.

So far, we have identified cases where observers may use high-fidelity imitation or mentalizing in the service of the same goal. This flexibility also provides a mechanism by which causal insights can be bootstrapped from faithfully transmitted cultural practices, thus blurring the lines between ritual and instrumental actions. Returning to the baking example above, you may assume that your friend's technique is the result of rational planning – that is, that she understands why each step in the recipe works and has arrived at her technique through deliberate utility maximization. But this is often not the case. The chemical reactions involved in bread-baking are sufficiently opaque that even a seasoned baker may faithfully copy a technique out of habit or conformity to cultural norms, without understanding why it works. If an observer were to then impute beliefs and rational planning to the demonstrator where there were none, they would be constructing a fiction – a "rationalization" of the demonstrator's behavior (Cushman, 2020).

This fiction can be quite useful. Technologies are often adopted and refined long before we discover why they work (Henrich, 2015). For example, the bark of the cinchona tree was used to treat malaria for centuries before its active ingredient, quinine, was first isolated and its pharmacological mechanism understood (Achan et al., 2011). Rationalization provides a means of representational exchange across different forms of social learning, enabling observers to extract generalizable, causal insights from cultural practices. This exchange may enable observers to innovate by design, by re-examining and refining long-held practices using their current internal models of the world.

In sum, beyond faithful copying, humans have access to a variety of cognitive capacities that enable us to learn from others. These capacities can be flexibly deployed and can support one another through representational exchange. Viewing social learning through the lens of computational trade-offs paints a more dynamic, agentic picture of how humans build culture.

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Tradition–invention dichotomy and optimization in the field of science

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