

# How Not to Find Over-Imitation in Animals

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## Abstract

While more species are being identified as cultural on a regular basis, stark differences between human and animal cultures remain. Humans are more richly cultural, with group-specific practices and social norms guiding almost every element of our lives. Furthermore, human culture is seen as cumulative, cooperative, and normative, in contrast to animal cultures. One hypothesis to explain these differences is grounded in the observation that human children across cultures appear to spontaneously over-imitate silly or causally irrelevant behaviors that they observe. The few studies on over-imitation in other species are largely taken as evidence that spontaneous over-imitation is not present in other species. This leads to *the over-imitation hypothesis* – that the differences between human culture and animal cultures can be traced to the human unique tendency to over-imitate. In this paper, we analyze the current state of the literature on animal over-imitation and challenge the adequacy of the over-imitation hypothesis for the differences between humans and animal cultures. To make this argument, we first argue that the function of human over-imitation is norm-learning and that over-imitation, like skill-learning, should be subject to selective social learning effects. Then we review the empirical evi-

dence against animal over-imitation and argue that these studies do not take into account the relevant variables given the normative and selective nature of over-imitation. We then analyze positive empirical evidence of over-imitation in great apes and canids from the experimental literature and conclude that the current body of evidence suggests that some canids and primates may have the capacity for over-imitation. This paper offers a methodological suggestion for how to study animal over-imitation, and a theoretical suggestion that over-imitation might be much more widely found among species. The larger implication for claims about human uniqueness suggests that if we do find widespread evidence of over-imitation across species, many of the current theories of human uniqueness that focus on human hyper-cooperation or social norms may have only identified a difference of degree, not of kind, between humans and other animals.

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## 1. How Not to Find Over-Imitation in Animals

The last 20 years have seen us reach a consensus position on the issue of animal culture. It is now widely believed that animal species from bees and fruit flies to fish and great apes have culture, or behavioral patterns that are socially transmitted and that may differ from group to group (Whiten, 2021).

Alongside the acceptance of animal culture have come claims about how human cultures are still distinct from

the cultures found in other animal species. Human cultures are taken to be more saturated with traditions that exist across many different domains, more cumulative, more collaborative, and more normative when compared with animal cultures (Henrich, 2016; Tomasello, 2019). Transmission chains of traditions have also been seen as more faithful in human cultures, with humans imitating behaviors precisely and animals sometimes thought to merely rediscover or emulate demonstrated behaviors (Heyes, 2018; Tennie et al., 2006, 2020).

To explain these differences between human and animal cultures, it has been proposed that only humans have a faculty for high-fidelity imitation (i.e., over-imitation) and that the tendency of human children to automatically over-imitate cultural behaviors creates the conditions required for a saturated socio-cultural environment (Clay & Tennie, 2018; Heyes, 2018; Tomasello, 2019). Over-imitation here refers to the faculty for copying actions that either (a) do not appear to be causally necessary for achieving a goal (Lyons et al., 2007; e.g., tapping on a container's lid three times before lifting it to retrieve the prize inside), or that (b) conform to performing an action the way that others do even if it is less functional (Nielsen & Tomaselli, 2010; e.g., retrieving a ball with a rake but the teeth are facing up). To say that over-imitation is a *faculty* we mean to focus attention on over-imitation as a behavioral pattern that may be supported by different cognitive mechanisms, just as memory or perception are faculties that are multiply realizable (Subiaul, 2010).

Children have an immense amount of information to learn in order to become fluent in their cultural context. They learn how to speak their community's language; they learn community rituals and rules of etiquette. Some of these are explicitly taught, such as when a parent explains to their child the restaurant rules. Others can be socially learned without explicit teaching, such as personal space rules. Some cultural norms can be learned by over-imitating, e.g., knocking three times before entering someone's home (not causally necessary to open the door) or wearing an uncomfortable garment (less functional means for covering one's body). Because many cultural behaviors are not causally necessary for achieving a goal, but instead are socially necessary, they can only be learned socially.

One of the first studies of children's capacity for socially learning a less functional behavior came before the term "over-imitation" was coined. In Meltzoff's seminal study, 14-month-old infants observed an adult demonstrate turning on a light box, not with their hands, but by leaning forward and pushing the on-button with their

head. The infants were then given the light box to explore. Meltzoff reports that the infants immediately copied the unusual behavior, using their heads to turn on the lamp, and did so again when tested 1 week later (Meltzoff, 1988). Although not reported for the original study, all infants in a latter version of the same task used their hands as well as their head to turn on the light (Gergely et al., 2002). Subsequently, children across cultures have been observed to over-imitate behaviors that are demonstrated by a trusted human (Hoehl et al., 2019).

In contrast, nonhuman apes have been reported to fail copying inefficient or unnecessary methods that are demonstrated to them (Horner & Whiten, 2005; Nagell et al., 1993) and to only rationally copy others' behaviors (Buttelmann et al., 2007). This proposed difference between animal and human over-imitation capacity has been used to explain why human and animal cultures appear to be so distinct. While human cultures differ from one another in rich details, cultural differences across animal species are fewer. While human cultures are the result of cumulative cultural evolution, animal cultures appear less complex. And while human cultures have social norms, animal cultures appear to only have behavioral patterns. The over-imitation faculty has been hypothesized to support the wide range of (causally) nonfunctional cultural differences we see in the everyday life of human societies because it allows children to acquire culturally important behaviors that are more fine-grained than the behaviors acquired by other species. The success of this appeal to over-imitation to explain differences between human and animal cultures rests on there being an absence of over-imitation among great apes, in contrast with humans. A handful of empirical tests of over-imitation in nonhuman great apes and canids have failed to find positive evidence of the faculty, and this null result has been taken to support the *over-imitation hypothesis* – the proposal that over-imitation is a phenomenon found only in humans and that it undergirds the creation of cumulative culture or cultural evolution (Clay & Tennie, 2018; Heyes, 2018; Tomasello, 2019). However, more recent studies with domestic dogs have found evidence of over-imitation (Huber et al., 2018, 2020), putting pressure on the thesis that over-imitation is unique to humans.

In this paper, we aim to revisit the question of animal over-imitation and challenge the adequacy of the received explanation in terms of differences between human and animal cultures. To make this argument, in §2 we argue that the primary function of human over-imitation is norm-learning. Then in §3, we turn to the empirical evidence against animal over-imitation which focuses on

great apes and canid behavior and argue that these studies do not take into account the relevant variables given the normative nature of over-imitation. Next, in §4, we review the positive evidence of over-imitation in canids, and reconsider the evidence for over-imitation in great apes, concluding that the current evidence suggests that these species may have the capacity for over-imitation. In §5, we consider one criticism of that claim: that non-humans lack the cognitive mechanisms required for over-imitation. Finally, in §6 we consider a number of implications of our critique of the over-imitation hypothesis. We offer a methodological suggestion for how to study over-imitation in other species, and we offer a theoretical proposal for why we might expect to find over-imitation widely across species. If our proposal is substantiated, it will have significant implications for claims about human uniqueness. Evidence of over-imitation across species should lead us to conclude that current theories of human uniqueness which focus on human hyper-cooperation or social norms may have only identified a difference of degree, not of kind, between humans and other animals.

## 2. The Function of Over-Imitation

There are three general approaches that have been advocated in the literature to explain the function of over-imitation: causal-learning, social-engagement, and norm-learning. Despite their differences of emphasis, we will show that causal-learning and social-engagement accounts also involve norm-learning elements. This entails that over-imitation should be seen as, at the least, having a norm-learning function in addition to other functions one might be inclined toward.

On *causal-learning* approaches, over-imitation has the function of helping children learn about the physical constraints of objects. Accordingly, high-fidelity imitation may have value for learning technological skills, with the social content considered to be a by-product (Lyons et al., 2007; McGuigan et al., 2007). On *social-engagement* approaches, the function of over-imitation is to promote affiliative relationships with demonstrators by copying their actions, whatever those action may be (Nielsen, 2006; Nielsen & Blank, 2011; Over & Carpenter, 2012). On *norm-learning* approaches, the function of over-imitation is to learn cultural practices or social norms at a young age (Allen et al., 2021; Kenward et al., 2011; Kiraly et al., 2013). Social norms are often opaque and may have their origins as an arbitrary solution to a coordination problem (Schelling, 1963), but importantly they are socially enforced by members of the community.

From a norm-learning perspective, children who over-imitate actions are learning how to embody the community's *social norms* – social standards of correct or appropriate behavior (Birch, 2021), or rules describing which behaviors are required, allowed, or forbidden in different situations for different members of the community (Kelly & Setman, 2020). This makes the norm-learning approach obviously normative. But we can easily see the normative elements in the causal-learning and the social affiliation approaches as well.

Consider first the causal-learning approach. When individuals learn technological skills, they are learning how to manipulate aspects of the material world in the way demonstrators do. This requires that they are learning how to match their actions to the demonstrator's standard, and adopting that same standard for themselves. Just as social norms have standards of correct behavior, so too do technological norms (Birch, 2021). The difference between the two doesn't have anything to do with a lack of a standard, but with a difference in the content of what that standard is about. Even the individual development of craft skills involves norms, but these are norms that may be individually represented by the actor. When a skill is transmitted from an expert to a naïve individual, the causal-learning approaches are also normatively saturated with culture, with infants learning about both causal functions and socio-cultural functions at the same time (Alessandroni & Rodríguez, 2017; Allen & Bickhard, 2017).

Consider next the social-engagement approach. Joint participation in social situations constitutes the basic sociality for humans (Carpendale & Lewis, 2015; Christopher & Bickhard, 2007), guiding our expectations about how others will act given the situation and the social roles, as well as guiding our own behaviors. Children's *know-how* to affiliate with others requires the existence of a convention about *how* to affiliate given the social situation (Bickhard, 2008). Such *know-how* can be defined in terms of action as mutually held interactive characterizations of situations. While for some social situations, like diaper changing (Adolph, 2008), the shared interactive characterization may be relatively idiosyncratic, for other social situations, like waving goodbye, the characterization is going to be more culturally constituted (Mirski & Bickhard, 2021). Accordingly, when children are learning about new social situations through imitation, they will generally interpret the demonstrated actions to be the *socio-culturally appropriate* way of acting in their effort to participate in the ongoing social reality (Allen et al., 2021). In order to successfully socially engage with caregivers, children will

have to successfully learn this social reality, which is richly structured by norms about how to affiliate.

We take the three accounts of the function of over-imitation to all capture part of what is happening when children over-imitate, and we see them as entangled with one another. By over-imitating, children are learning how they should interact with objects and people in different types of social situations. For the developing infant/toddler, learning to participate in the social world around them will involve learning about (socio-cultural) normative constraints which guide behavior in accordance with social realities. Such guidance can involve either a restriction or an enabling of behavior in terms of negative or positive constraints, respectively. A positive constraint is one that opens the space of possible actions (e.g., the game of soccer opens the possibilities for what can be done with the ball – scoring a goal or making a pass requires the game). A negative normative constraint is one that limits a person's behavior – the “can't” of normativity means that the behavior is not appropriate, even if it is physically possible. We cannot go to work naked or greet a stranger with a bear hug not because of any physical limitation but because of (socio-cultural) normative constraints.

Importantly, normative constraints presuppose physical constraints; norms are not free to vary irrespective of any physical considerations. We cannot learn the norms for the game of soccer if the ball is made of stone. For this reason, cognitive factors concerning children's understanding of the physical world must also play a role in norm-learning. Similarly, social-cognitive and social-motivational factors may also influence children's understanding of what is *supposed* to be copied when learning about how one *should* interact in the situation (Allen & Ilgaz, 2017, also see Hoehl et al., 2019 for a review of the various factors that can influence what gets copied during an over-imitation situation).

A norm-learning function of over-imitation makes sense of the integrated way in which children learn about objects, people, and society (i.e., all knowing is in terms of different forms of interaction and the corresponding normativities). It also offers a rationale for the seemingly odd behavior that was identified by Meltzoff (1988). Children conform even when there is no clear reason for conformity, and there may be *prima facie* reasons to not conform (because, e.g., it is more natural to turn on a light using one's hand). Here, we see a source for the learning of opaque cultural rules that do not admit of rationales. Children should eat, dress, talk, behave *this way* not because it is the best way, but because it is *our way*.

### 3. Does the Animal Over-Imitation Literature Test for Over-Imitation Given Its Norm-Learning Function?

We now turn to evaluate the animal literature on over-imitation, given its norm-learning function. We suggest that the studies that fail to find evidence of over-imitation in animals may have involved confounds that make sense of why the animals would not have over-imitated in these contexts, given that the normativity of over-imitation has a direct implication about who one should learn from. After reviewing the studies, we identify the confounds to be avoided in any successful experimental studies of over-imitation.

In the human literature, the design of over-imitation studies reflects a sensitivity to the capacity's normative nature by using same-group members as demonstrators. The animal learning literature has documented selective social learning in a variety of species (Camacho-Alpizar & Guillette, 2023), showing that animals won't learn from just anyone, either. However, in the studies that failed to find evidence of over-imitation in animals, the demonstrators are human actors, raising the possibility that the demonstrators were not the right kind of individuals to learn from. While we acknowledge that a human could be a nonhuman animal's in-group member and hence in some contexts could be seen as a reliable demonstrator, we observe little discussion of these issues in the great ape literature on over-imitation (though see Boesch, 2012).

In two studies designed to elicit spontaneous over-imitation, researchers have failed to find evidence that great apes share children's tendency to copy actions that appear causally irrelevant (Clay & Tennie, 2018; Horner & Whiten, 2005). While animals can be trained to copy demonstrators, as in the “do as I do” studies performed with a range of species including apes (Call, 2001; Cusance et al., 1995; Miles et al., 1996), dogs (Fugazza & Miklósi, 2014; Range et al., 2011), and domestic cats (Fugazza et al., 2021), these abilities are the result of training procedures rather than spontaneous acts. Children do not need to be trained to over-imitate.

Before many of the theoretical discussion about the possible functions of over-imitation, primatologists Victoria Horner and Andrew Whiten provided over-imitation opportunities to 12 chimpanzees, ages 2 to 6 years old, who were living in a sanctuary in Uganda after being rescued from the bushmeat trade (Horner & Whiten, 2005). Demonstrators used a tool to access food from opaque and transparent boxes by engaging in two types of actions, the first unnecessary, and the second necessary. The chimpanzees more frequently imitated the irrelevant actions on the opaque box than on the

transparent box. The interpretation is that the chimpanzees understand the causal structure of the transparent box but not the opaque one and were not motivated to copy actions they knew to be causally irrelevant. This is in contrast to a test of preschool children using the same procedure and apparatus; the children tended to perform the two types of actions in both the transparent and opaque contexts.

This experiment has been taken to provide compelling evidence that chimpanzees do not over-imitate. However, we find a problem with this conclusion given that the chimpanzee subjects may have been selectively *not* copying the human researcher who demonstrated the behavior. There are two related features of this situation that could trigger the chimpanzee's hesitancy to over-imitate: the fact that the demonstrator was an out-group member, and the fact the skill being demonstrated was a food processing task in which humans and chimpanzees typically employ different techniques. Compare this context with the one for the children, in which the demonstrator was a same species social partner, and shared the same physical abilities for manipulating objects. Humans do not serve as the best demonstrators for chimpanzees needing to learn food processing tasks since chimpanzees have physical capacities that humans do not. If a chimpanzee were to learn how to process food items by copying humans rather than other chimpanzees, they would fail to live up to their potential. Great apes can use their powerful jaws to open coconuts, e.g., a behavior human could never demonstrate. For that reason, the failure of the chimpanzees to over-imitate the obviously causally irrelevant action in this study may be interpreted as an example of so-called rational imitation, which we also see evidence of in children (Gergely et al., 2002) and dogs (Range et al., 2007). Rational imitation refers to failures to over-imitate behavior when there is a defeating explanation for the action, like turning on a light box with one's head because one's hands are otherwise occupied. Of course, it is difficult to empirically distinguish between rational imitation and a mere failure of over-imitation, thus cleaner tasks of over-imitation should not involve behaviors that could be explained by the demonstrator's physical limitations. For a human to serve as a relevant demonstrator for a chimpanzee given the norm-learning hypothesis, the humans would have to be seen as a community member and the task should be one that is not open to defeating explanations.

The other peer-reviewed paper failing to find over-imitation in great apes is a recent comparison of sanctuary living unenculturated bonobos and children 3–5 years old (Clay & Tennie, 2018). Subjects observed a

demonstrator opening a box made from a short log split through the middle and held together with two interior pegs. When closed, the box looked like a section from a thick tree branch. Subjects were shown a demonstrator rubbing the box, twisting their wrist in the air next to the box (uncommon actions for bonobos), and then opening the box, or a demonstrator using their finger to draw a cross on the box and then outlining the groove of the box before opening (a more familiar action for bonobos). Children but not bonobos were also shown simple demonstrations of opening the box, without any additional actions. After the demonstration, subjects were given a version of the box that didn't open and had 2 min to interact with it. Children tended to copy both types of irrelevant actions, but none of the 46 bonobos copied any of the demonstrated actions, preferring to engage in species-typical food processing methods such as biting, pounding, kicking, or shaking the box. Almost half of the children requested assistance from the experimenter, as did over 20% of the bonobos. The authors suggest that the over-imitation seen in the children but not the bonobos could be explained by human's hyper-sociality, which they take to be key to social and material cultural evolution. However, from the perspective of the norm-learning hypothesis, we should expect that unenculturated bonobos would not copy actions demonstrated by human demonstrators, given that humans are outgroup members who have a number of physical constraints when it comes to manipulating a section of log.

Negative results have also been reported for canids (Johnston et al., 2017). In a study of dogs and dingoes, an experimenter demonstrated how to open a box to gain a food reward by engaging in an irrelevant act – pushing a lever on the box – and then a relevant act – taking the lid off the box. Dogs had their owner in the room, but their eyes were closed during the demonstration. Dingoes had handlers in the same role as the dog owners. While dogs, and to a lesser extent dingoes, sometimes interacted with the lever before taking the top off, these behaviors declined over time, suggesting that the subjects were learning that the lever was irrelevant. For both species, the use of unfamiliar humans as demonstrators failed to consider the possible role of selective over-imitation in the subjects' willingness to persist with the causally irrelevant action.

These null results in the studies described above are often interpreted as evidence that there exist social-motivational differences between nonhumans and humans that reflect humans' unique capacities for joint action, cooperative practices, and social identification

(Shipton & Nielsen, 2015; Tomasello, 2016a, 2019). However, given the norm-learning function of over-imitation, we think it is at least as likely that the experiments do not include the right conditions to elicit over-imitation in the nonhuman test subjects.

The ape and canid research cited in defense of human uniqueness claims does not include a culturally relevant model, and so the norm-learning function of over-imitation would not be indicated. Given the expectation that over-imitation will be selective given its normative function, the current negative findings about ape and canid over-imitation that do not take selective social learning into account should not be interpreted as evidence that these taxa do not engage in over-imitation. Accordingly, modifications in animal research to test for norm-learning over-imitation would take the function of over-imitation into account by using reliable in-group demonstrators who are in a position to know the relevant norms.

We propose that to test over-imitation in animals given its norm-learning function, there are at least three relevant variables for researchers to keep in mind: (1) the status of the demonstrator as in-group or out-group; (2) the status of the demonstrator as reliable or unreliable; (3) the perceived physical limitations of the demonstrator. The first variable reflects the rationale that cultural norms are sustained across generations when the practices of one's in-group are preferred to the practices of out-group members. The second variable reflects the rationale that the judgment of reliability impacts the usefulness of learning the group's norms from that individual. We take reliability in a normative context to include high status or prestigious in-group members. And the third variable reflects the rationale that the odd behaviors cannot be explained by some idiosyncratic or irrelevant physical limitation of the demonstrator. Just as children "rationally over-imitate" by not copying a demonstrator who turns on a lamp with their head when their hands are occupied (Gergely et al., 2002), other species may be able to recognize when a behavior is not reflective of a general pattern but is caused by some local condition.

This is not to say that we expect chimpanzees or other species to always demonstrate insights about who is reliable or have robust knowledge of the causal structure of the physical world. This is as true for selective-copying (e.g., copying the older, the prestigious, the experienced) as it is for selective-over-imitation. Unreliable demonstrators may also sometimes get copied, and causal properties that are apparent to an observer may be opaque to a learner, especially when the observer is looking at the behavior of another species. Rather, we

mean to draw attention to these three variables as elements to consider when designing studies. Further, when interpreting null results, researchers can consider whether these three variables may help formulate an alternate explanation for the null result.

Given these three relevant variables, we propose that minimally, any study purporting to show that an animal does not over-imitate must use in-group members as demonstrators. Our suggestion is that an adequate study of over-imitation in animals would use as demonstrators reliable in-group members whose actions are not easily interpretable as being due to a physical constraint. Studies of over-imitation in animals that attend to some of these variables do exist, and we take them to provide positive evidence of over-imitation in primates and in domestic dogs.

#### 4. Evidence of Over-Imitation in Animals

The growing acceptance of animal culture provides a reason to expect that we might find over-imitation in a range of animal species. From the early observation of one group of Japanese macaques on Koshima Island washing sweet potatoes in the water before eating them (Imanishi, 1957), scientists then came to identify culture in chimpanzees (Whiten et al., 1999), whales and dolphins (Whitehead & Rendell, 2014), and birds (Aplin, 2018). Today a number of scientists now endorse the idea that there is culture in a large number of animal species (Schuppli & van Schaik, 2019; Whiten, 2019, 2021), including fish (Mathis et al., 1996), bumble bees (Alem et al., 2016), and fruit flies (Danchin et al., 2018). If the function of over-imitation is to learn the cultural affordances and social norms of one's cultural group, and many species have culturally distinct behaviors, then there is reason to ask whether some version of over-imitation is found in these other species as well. However, differences in cultural behaviors need not rely on over-imitation because the behavioral differences can be supported by a number of different social learning approaches, including imitation, emulation, affordance learning, and stimulus or local enhancement (Whiten, 2021).

By turning to look at the animal social learning literature, we can find evidence supporting over-imitation in apes and domestic dogs. In dogs, there is experimental evidence of over-imitation involving causally irrelevant circumstances (Huber et al., 2018). In a study of 72 dogs brought into the Clever Dog Lab by their human caregivers, the humans were first taught a series of

movements that they then demonstrated to their dogs. In the irrelevant action condition, caregivers walked to a wall, got down on hands and knees, touched a yellow and then a blue dot with their nose, then stood up and walked to a sliding door in the wall, again got on hands and knees, and slid open the door with their nose to expose a piece of sausage, which they then took out with their hands and showed to their dog. When given the opportunity to move around the room, about half the dogs engaged in the causally irrelevant dot touching before sliding open the door to get the sausage.

In a follow-up study, Huber and colleagues found that family pets failed to over-imitate an unknown experimenter demonstrating the same action, even when their caregiver was in the room (Huber et al., 2020; see also Huber et al., 2022). This is exactly what we would expect given the norm-learning function of over-imitation. Huber and colleagues characterize over-imitation as a consequence of social-motivational factors related to affiliation. They hypothesized that dogs were more likely to over-imitate than apes because dogs relate to their owners in socially relevant ways, while apes do not have such relationships with humans. However, we suggest that the norm-learning function of over-imitation is supported by the pair of findings from the Clever Dog Lab. The dot touching behavior is demonstrated by in-group members – the dog’s person – and the behavior is not one that reflects a physical constraint of the human. The dogs’ tendency to over-imitate their human, but not an unknown human, suggests that there is either an affiliative or a normative explanation for the behavior. Further research would be needed to tease apart those two possibilities. We also acknowledge the possibility that there may be different explanations for different species, as noted earlier.

Evidence of over-imitation in chimpanzees comes from both experimental studies of imitation in enculturated animals and from observational studies of wild chimpanzees. Two imitation studies that have not been discussed in the context of over-imitation are illustrative of findings in chimpanzees. One such study comes from the Primate Research Institute in Kyoto, founded by Japanese primatologist Tetsuro Matsuzawa in 1978 with the acquisition of a female chimpanzee infant named Ai. For over 40 years Matsuzawa has been working with Chimpanzee Ai, as well as her son Ayumu since his birth in 2000. He refers to Ai as his “research partner” and has developed a close personal bond to the chimpanzees. The PRI researchers use a methodological approach called “participant observation” according to which there is a triadic bond between a chimpanzee mother, her infant,

and a human researcher (Matsuzawa, 2017). The three individuals spend a significant amount of time together each day, resulting in deep relationships. In this way, the conditions at PRI are such that the human caregivers are in-group members, despite being from a different species. Before over-imitation in animals became a topic of study, Matsuzawa and colleagues demonstrated over-imitation in five female chimpanzees living together at PRI (Myowa-Yamakoshi & Matsuzawa, 2000). For each chimpanzee, her human caregiver demonstrated the behavior as they sat together face to face in a familiar playroom (unlike through a cage or plexiglass barrier, as in the null studies described in the previous section). Eight object pairs were demonstrated, with each pair consisting of a container and a tool that was used to open the container. In all conditions, the tool was not necessary for opening the container. One pair consisted of a wooden box and a wooden fork-like shape, and the demonstrator showed how to use the fork as a lever to lift the top off the box. The chimpanzees tended to use the tool on the box, even though the tool was not necessary, and was not used by chimpanzees to open the box when the behavior was not demonstrated. This experiment differs from the null experiments in two important ways. For one, as already stated, the demonstrator was a reliable in-group member. But just as importantly, the task was not designed to be a food processing activity. There were no rewards inside the containers, but all subjects were rewarded after 3 min when they were invited to exchange the objects for some food. Given this structure, the task could not be interpreted as a simple means to an end of acquiring food but invites a normative explanation that these cultural items are to be handled in a particular way. We take this study to serve as an adequate test of over-imitation in chimpanzees in the Nielsen & Tomaselli (2010) sense because the action involved copying a less functional means for achieving the goal, and the three variables we described in the previous section are all accounted for; the demonstrator is a reliable, in-group member who is not easily interpretable as acting due to physical limitations.

Another study that we interpret as evidence of over-imitation in chimpanzees comes from a study designed to examine social learning techniques and the transmission of behavior among individuals in a single community (Whiten et al., 2005). In this study, researchers designed a foraging apparatus that could be manipulated to access food using the same tool in two different ways, either by poking the tool into a hole or placing the tool under hooks and lifting. The poke method was taught by a human to a high-ranking female chimpanzee of one group, and the

lift method was taught to a high-ranking female in another group. Once the behavior was trained, the expert chimpanzee was permitted to access the apparatus while being observed by the other group members who lacked access. After a week of observations, the group members were permitted access to the apparatus, and chimpanzees tended to demonstrate the observed behavior. Even when the alternate behavior for accessing food was discovered, chimpanzees tended to conform to the behavior demonstrated in their group.

We find this study also meets the criteria we set out for an adequate study of over-imitation in animals, as the demonstrator is a high-ranking/reliable in-group member, and the behavior is not one that could be the result of a physical constraint. Indeed, though the demonstrated behavior is a food processing task, and it appeared that the poke action was easier to perform than the lift action, chimpanzees in the lift group who also discovered the poke action continued to lift, making the copied behavior less functional than the alternative. Though both poking and lifting were causally efficacious ways of accessing the food, the conformity demonstrated in this experiment is aligned nicely with the conformity of children in the original Meltzoff over-imitation task, in which children used a more difficult method for turning on a light box after it was demonstrated. The observation that chimpanzees are selective about their imitation has continued to be supported in social learning study's findings that chimpanzees are more likely to imitate dominant individuals than lower ranking ones, even if the low-ranking chimpanzee behavior is more efficient (Kendal et al., 2015). Thus, in experimental contexts that meet the constraints to motivate normative copying, we do see evidence of over-imitation in great apes.

We note that the chimpanzee studies only provide evidence of one form of over-imitation, the less functional copying of actions described by Nielsen & Tomaselli (2010). What we still lack evidence for in chimpanzee is the sort of over-imitation seen in the dogs, described by Lyons et al. (2007) in which participants copy an extra action that is not causally involved in the goal.

## 5. In Defense of a Real Patterns Approach to Imitation

In response to the empirical findings that suggest dogs and chimpanzees over-imitate, critics may protest that these species lack the cognitive capacities needed for true imitation, so the findings should not be interpreted as evidence of over-imitation. Alternative explanations of

these behavioral patterns may be given in terms of a combination of social learning about interesting outcomes (through, e.g., local or stimulus enhancement) and individual learning at those points of interest (e.g., at the “zone of latent solutions”) (Tennie et al., 2020). That is, the critics worry that apes do not naturally ape because we can explain what looks like imitation through appeal to a combination of psychological mechanisms that supports the behavior. This worry understands “imitation” and “over-imitation” to refer to a set of shared cognitive mechanisms, perhaps related to the mirror-system, empathy, or even theory of mind (Goldman, 2005; Meltzoff, 2011) – mechanisms that animals may not have.

We understand the worry, but think that the investigation into over-imitation will be more fruitful if we do not presume the existence of a shared over-imitation system in humans – much less a shared system across species. While it is true that over-imitation is sometimes presented as a mechanism, as we made clear at the beginning of this paper, we think more progress can be made by focusing on the behavioral pattern as the explanandum, rather than starting with assumptions about the cognitive mechanisms involved in supporting a pattern of behavior. Imitation has been helpfully described as a behavioral pattern that may be supported by a number of different mechanisms (Subiaul, 2010). Norm acquisition, too, can be seen as a pattern of behavior that is supported by a number of different cognitive capacities, including direct instruction through language, mind-reading/mentalizing other people's expectations, social learning heuristics such as “copy the majority,” reinforcement learning, and biological inheritance (Westra & Andrews, 2022). Likewise, the tendency to copy causally irrelevant behaviors demonstrated by reliable in-group members could be supported by a number of mechanisms. For example, the over-imitation demonstrated by Chimpanzee Ai and her companions may have been supported by mindreading capacities that led her to attribute to Matsuzawa a special feeling toward this particular box. Clearly, we do not have evidence of this explanation of Ai's behavior, but the point is to say that over-imitation is a black box when it comes to mechanisms. Just as one may imitate silly actions for different reasons, different cognitive mechanisms may be involved in supporting a behavioral pattern of over-imitation within a single species. Additionally, different cognitive mechanisms may be more or less common in different species. Our response to the worry raised in this section is that we need to separate the question of cognitive mechanism from the question of whether a particular behavioral pattern exists. This “real patterns” (Dennett



1991) or “outside-in” (Westra & Andrews 2022) approach to comparative cognition research involves characterizing the phenomenon to be studied while making minimal assumptions about cognitive processes (Fitzpatrick et al., in prep). Only if we find robust evidence of the behavioral pattern of over-imitation in other species, can we examine the cognitive mechanisms that support it.

## 6. Implications and Conclusions

Given that the function of over-imitation is norm-learning, and that norm-learning requires engagement with other reliable and trustworthy community members, the current evidence supports the hypothesis that other animals over-imitate. The null findings in ape research did not use culturally reliable models (e.g., human experimenters who are out-group members) which undermines these studies as providing evidence *against* ape over-imitation capacities. While we have some support for animal over-imitation, the evidential status is not robust, and we hope to see more studies investigating the question of over-imitation, especially when it comes to the introduction of additional, causally irrelevant steps to achieving a goal.

If we gain robust evidence that other species also engage in over-imitation, it will offer further support for the claim that other species are normative beings whose communities are guided by social norms (Andrews et al., 2024; Westra et al., 2024). Recent arguments in favor of animal social norms and normative cognition in other species will be bolstered by the evidence that these species also engage in over-imitation, given its norm-learning function (see, e.g., Andrews, 2020a; Danón, 2019; Fitzpatrick, 2020; Vincent et al., 2019; though Powell et al. (2023) argues that social norms in eusocial insects do not require a capacity for imitation because they do not need to be learned, for species with plastic social norms there will have to be some learning and hence some kind of selective imitation). The current evidence supporting over-imitation in other animals offers additional support for animal normativity since the stronger the normative constraints are in a society, the more need there is for over-imitation. However, the current evidence also raises new questions for the explanations about the differences between human and animal cultures. We no longer have a ready-to-hand explanation for the differences in the degree of cumulative culture between humans and other species if the over-imitation faculty is preserved across species.

### 6.1 Suggestions for Future Research

The methodological suggestion to come from this review is to use culturally relevant models in over-imitation paradigms with nonhuman primates. Such models should be selected to maximize reliability in that they should have culturally relevant knowledge and should relate to the learner in a way that presupposes the relevant form of “trust.” For some nonhuman primates, dominant in-group members may be the most appropriate model to elicit over-imitation. It may also be the case that using a broader range of activities that do not focus on artifacts with extrinsically motivating outcomes could be worthwhile. Artifacts with clear instrumental purposes (i.e., to retrieve food) may set up competing motivations that make such paradigms a particularly challenging type of context for observing over-imitation in other species.

For human development, the attachment relationship seems to provide a foundation for the sort of trust that is needed for learning from others. Further, it is clear that young preschoolers will learn from a model that is socially reliable even if they are not epistemically reliable (Harris & Corriveau, 2011). Accordingly, we suggest that future work could also examine over-imitation in species that develop something similar to an attachment relationship, such as marmosets (Burkart & van Schaik, 2010; Hrdy, 2009). Relatedly, it may be relevant to take a developmental approach to nonhuman primate social learning. By about 4 years of age, human children are quite selective in terms of what they learn and who they learn from (Koenig & Sabbagh, 2013). Much of this selectivity is a consequence of learning about different types of cues that signal the reliability of an informant in different situations. Future studies of nonhuman animals can examine whether there is a similar developmental change in the selectivity of social learning. Do apes or dogs also learn who to learn from over time?

### 6.2 Implications for Human Uniqueness, Shared Intentionality, Cooperation, and Norms

The theoretical implication is that the preliminary evidence for over-imitation in dogs and primates is also preliminary evidence for norms in dogs and primates. Critics who deny animal social norms often do so on the grounds that animals lack some essential cognitive mechanism that supports cooperation or morality such as theory of mind or shared intentionality (e.g., Tomasello et al., 2005; Tomasello, 2016b, but see Papadopoulos, 2021; Papadopoulos & Andrews, 2022 for a different perspective). Since our description of a behavior as “over-imitation” is silent on mechanism, it is consistent with

different accounts of the cognitive mechanisms required for cooperation and other normative behavior, and we cannot conclude animals lack social norms because they lack the necessary psychology for social norms. Rather, we think that by looking at animal behavior we can help uncover the cognitive mechanisms that support normative cognition more generally, including norm learning, norm enforcement, and norm facilitation. It may be that this new lens offers surprising insights. We propose that fairly simple and phylogenetically widespread cognitive mechanisms can support over-imitation and normative cognition more generally. For one, an (inter)action-based approach to cognition makes sense of both cooperation and shared intentionality in ways that suggest their presence in other species. If understanding the intentions of others need not involve mindreading beliefs (Andrews, 2012), then neither does the sharing of such intentions (Papadopoulos, 2021) or joint action (Butterfill & Sinigaglia 2023). That is, if sociality can be characterized as a space of interactive affordances rather than mindreading (Bickhard, 2008), then shared interactive practices can be learned through experience with others (Racine & Carpendale, 2007a, 2007b). Further, an (inter)action-based approach sees foundational forms of cooperation as a consequence of the intrinsic nature of interacting with other agents. In short, cooperation is inherent in the need for interactive coordination. The sharing of more explicit goals outside of the interaction activity itself is an extension of the more basic coordination rather than a prerequisite to it (Christopher & Bickhard, 2007).

In addition, a pluralist approach to social and normative cognition suggests that such behavioral practices are supported by a number of different cognitive mechanisms even within the human species. Pluralistic approaches to folk psychology and social cognition stress the importance of strategies for prediction and explanation other than mindreading beliefs, including representations of the situation, traits, stereotypes, and (notably) social norms (Andrews, 2012; Andrews et al., 2020). Just as there are many ways of doing social cognition, there are many ways of doing norms. The category of norms in human lives is large, messy, and heterogeneous on many dimensions, and consequently there is a plurality of mechanisms that support “ought-thought,” including capacities for norm acquisition, norm conformity, and norm enforcement (Westra & Andrews, 2022).

Finding over-imitation in animals allows us to see that the mechanisms purported to be necessary for cooperation or other normative behaviors may be different, and cognitively simpler, than often supposed – in humans as

well as in other animals (Shettleworth, 2010). Following Morgan’s Challenge (Andrews, 2020b), psychologists can provoke themselves to consider whether behaviors that appear to be clever, *human or nonhuman behavior alike*, are really so special. In his autobiography, C. Lloyd Morgan wrote: “To interpret animal behavior, one must learn also to see one’s own mentality at levels of development much lower than one’s top-level of reflective self-consciousness. It is not easy, and savors somewhat of paradox” (Morgan, 1930, 250). Morgan already recognized how difficult it is for us to follow his advice not to over-intellectualize human cognition.

The deep implications of animal over-imitation for theories of human uniqueness and cultural evolution require a close examination of the current state of our knowledge regarding animal over-imitation. We think that current evidence, while preliminary, suggests that over-imitation may not be unique to humans, and hence that the over-imitation hypothesis may be false. Thus, we recommend that further research be done – research that is sensitive to the norm-learning function of over-imitation.

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No ethical approval was required.

### **Conflict of Interest Statement**

The authors declare that there is no conflict of interest.

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### **Author Contributions**

Jedediah W.P. Allen and Kristin Andrews contributed equally to the conception and writing of the paper.

### **Data Availability Statement**

The manuscript is not an empirical study with data collection.

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