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Original Article

The perpetuation of ritualistic actions as revealed by young children's transmission of normative behavior

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ABSTRACT

Children will comprehensively copy others' actions despite manifest perceptual cues to their causal ineffectiveness. In experiment 1 we demonstrate that children will overimitate in this way even when the arbitrary actions copied are used as part of a process to achieve an outcome for someone else. We subsequently show in experiment 2 that children will omit arbitrary actions, but only if the actions are to achieve a clear, functional goal for a naïve adult. These findings highlight how readily children adopt what appear to be conventional behaviors, even when faced with a clear demonstration of their negligible functional value. We show how a child's strong, early-emerging propensity for overimitation reveals a sensitivity for ritualistic behavior.

1. Introduction

Activities basic to our survival, such as eating, drinking, and courtship, vary remarkably from country to country, sometimes even from region to region. Such diversity arises from our drive to act in accordance with our social in-group. We are motivated to be like others and to act as others do so that they will like us (Lakin, Chartrand, & Arkin, 2008). Acting in accordance with our in-group enhances health and well-being while avoiding scorn and isolation (Jetten, Haslam, Haslam, & Dingle, 2014). For example, eating in the same fashion as our group members may be as important as the act of eating itself. Herein lies a paradox: What if the pursuits of those around us comprise redundant processes that, at least for efficiency's sake, we should ignore? Would we only focus on those actions having clear functional valence? Recent research suggests that we would not.

From early in life we are prone to copy others' use of objects so inclusively that we incorporate visibly, causally irrelevant actions (Horner & Whiten, 2005; Lyons, Young, & Keil, 2007; Nielsen, 2006). This tendency to 'overimitate' increases with age (Marsh, Ropar, & Hamilton, 2014; McGuigan, Whiten, Flynn, & Horner, 2007) and is prevalent in starkly contrasting cultural groups (Nielsen, Mushin, Tomaselli, & Whiten, 2014; Nielsen & Tomaselli, 2010). According to Lyons and colleagues (Lyons, Damrosch, Lin, Macris, & Keil, 2011; Lyons et al., 2007) children show this puzzling behavior because they are yet to develop a mature understanding of the connection between actions and their outcomes and hence interpret any demonstrated action as causally necessary. Contrasting with this perspective are accounts that see overimitation as something socially driven that children engage in despite being fully aware of the redundancy of any irrelevant actions employed. Proponents of the affiliation view (Nielsen, 2008; Nielsen, Moore, & Mohamedally, 2012; Nielsen, Simcock, & Jenkins, 2008; Over & Carpenter, 2012, 2013) suggest overimitation arises from a human-specific tendency to copy as a way of showing others they are like them and in turn to be liked by them, whereas normativity accounts couch the replication of redundant actions as being viewed as part of a broader action sequence that, although causally irrelevant, are nevertheless an essential and obligatory part of the activity (Kenward, 2012; Kenward, Karlsson, & Persson, 2011; Keupp, Behne, & Rakoczy, 2013). Regardless of their veracity, each of these perspectives overlooks a fundamental aspect of human behavior.

As our ancestors emerged from the Middle Paleolithic, social group size began to increase from those typical of non-human apes and towards numbers commensurate with modern humans (Dunbar, 2003). With increasing group size came the possibility of cumulative culture (Muthukrishna, Shulman, Vasilescu, & Henrich, 2014), generating the ever more sophisticated repertoires that have contributed crucially to our species' remarkable success (Tomasello, 1999; Whiten, 2005). With population size increased, new necessities and problems arose, including issues related to co-operation, allocation of resources, and social living. The pressure to distinguish devoted in-group members from imposters or interlopers became increasingly important, as did the need to gain social acceptance, and avoid ostracism, from majority group members.

Actions we execute deliberately, meticulously and intentionally, can be highly informative. These actions, when costly (in terms of time,

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energy or physical endurance) reliably indicate commitment to in-group beliefs (Atran & Henrich, 2010; Henrich, 2009; Soler, 2012). When we willingly undergoing a costly initiation rite, like scarification, we lend greater credibility to our claim as a loyal tribe member than vocal exhortations of the same (Sosis, Kress, & Boster, 2007). In our evolutionary past those relying on verbal instruction to learn the attitudes and behaviors leading to social approval would have likely been at far greater risk of manipulation, and hence of fitness disadvantage, than those who could critically evaluate words relative to actions (Henrich, 2009; Rossano, 2012). Ritualistic actions have thus played a critical role in the development of human society.

According to Rossano (2012) a number of behavioral steps are necessary for actions to become ritualized. Critical elements of a larger set of behaviors are isolated and become more restricted and stylized in their execution. Ritualized actions must also be executed in a prescribed manner, repeated to attract and hold attention, and the goals demoted such that the acts performed are ends unto themselves and are not necessarily associated with an instrumental outcome. Rossano explicitly states that these are also the features that define overimitation. Exhibiting overimitation can thus be seen in the context of children's adaptive inclination to adopt ritualized actions, to do something because "this is how it is done here".

To appear intentional, overimitation actions are typically communicated to children in a clear, deliberate manner. According to the theory of human pedagogy (Csibra & Gergely, 2009) children have a natural predisposition to learn actions modeled in this way, assuming relevant cultural information is being taught. Overimitation might therefore arise because children are responding to the cues of a person who they assume is teaching them something important, kind-relevant and generalizable (Hoehl, Zettersten, Schleihauf, Gratz, & Pauen, 2014). If children interpret the redundant actions employed in overimitation tasks as ritualized behavior, indicating something akin to "this is how we do it here", causally redundant actions should still be reproduced when pedagogical demand characteristics are diluted. Experiment 1 tested this.

Children first joined an experimenter (E1) who played with one of her 'favorite' toys. E1 subsequently placed the toy in a box and left the test environment. A second experimenter (E2) entered, took the toy from the box, played with it then placed it in a new box, subsequently demonstrating how the box could be opened using causally irrelevant actions in the process. E1 then returned, looked in the original box, and exclaimed that she did not know where her toy had gone. The key here is how children chose to open the new box given: (a) it is 'for' a naïve adult rather than a demonstrator who is no longer present; and (b) E1's request shifts the focus of the task towards the outcome and away from the actions. We compared children's responses to a standard overimitation situation and a social pressure condition where E2 remained in the test room when E1 returned to find her toy had been removed from the original box.

If children interpret E2's actions in a ritualistic manner and exhibit them to signal alignment with the experimenters as new social partners they should imitate the irrelevant actions when opening the box for E1, regardless of condition. Conversely, if they are primarily motivated to demonstrate to E2 that they have learned what has been taught to them, the irrelevant actions should be exhibited at the lowest rates when E2 is absent and the ostensible aim is to help E1. In contrast, the causally relevant actions should be replicated at equal rates across conditions as there is little reason to omit them given they are associated with bringing about the target outcome.

2. Experiment 1

2.1. Method

2.1.1. Participants

In total, 49 children participated in this experiment. Four were excluded due to experimenter error, one for inattentiveness, and two for refusing to participate. A final sample of 42 children remained (26 males and 16 females) of four years of age (M = 54 months, range = 48–59 months). We chose this age group as it spans a period when overimitation has become an established part of young children's behavioral repertoire. Studies of imitation in young children commonly employ cell sizes of 12–15 children per condition (Flynn & Whiten, 2008; Nielsen & Blank, 2011). It was thus decided to cease data collection once 14 children had been tested in each condition. Participants were recruited from an existing pool of parents who had previously expressed interest in having their child take part in developmental research. Parents were contacted via a letter in the mail and by phone, and those interested in volunteering brought their children to the university for testing. The majority of the children participating were Caucasian and from middle-class socioeconomic backgrounds. Children were randomly assigned into one of three experimental conditions. All children were presented with a small gift and certificate of participation.

2.1.2. Apparatus and test environment

Testing was carried out in a dedicated child-friendly test room of a university-based child development research facility. The test room consisted of a play mat, a chair, a cushion for the child to sit on, a small couch for parents to sit on, and a black wooden screen to conceal the apparatuses before use. Sessions were videotaped using a camera mounted on a tripod positioned in the corner of the room.

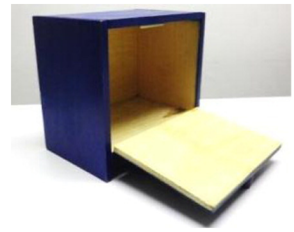
2.1.2.1. Boxes. Four distinct boxes (see Table 1), each having a different color, design and opening mechanism were used throughout testing. Two were designated as initial location boxes (blue box and purple box), and children did not act on these at any time during the experiment; rather they were used as props for the task narrative. The blue box (15 cm × 22 cm × 15 cm) was wooden, and its hinged lid opened downwards like a trap door. Pulling a small knob fixed to the lid opened it. The purple box (21 cm × 15 cm × 10 cm) had a rectangular base and a rounded lid, and could be opened by unlatching a metal clasp attached to the front and pushing the lid up.

The changed location boxes were acted on by the children. The green switch box (19 cm × 12 cm × 6 cm) was mounted on a wooden base (19 cm × 36 cm). Sliding a teddy bear-shaped knob located on the front of the box horizontally from left to right released a hidden, spring-loaded mechanism thereby opening the lid. The wooden box (30 cm × 19 cm × 10 cm) was mounted on two wooden supports, and pushing the lid up via two small metal loops fixed to the front could open its hinged lid. The order of presentation of the boxes was counterbalanced across trials.

2.1.2.2. Tools. The changed location boxes were presented along with the following tools: 1) a 16 cm yellow drumstick with rubber end; 2) a 19 cm green wooden mallet; 3) a 20 cm orange-colored dowel; and 4) a 35 cm red-colored rectangular stick. The drumstick and wooden mallet were always presented with the wooden box, and the orange stick and red stick were always presented with the green switch box. One tool from each pair was placed to the immediate left of the box, and the other was placed to the immediate right, counterbalanced across boxes, conditions, and participants.

2.1.2.3. Sequence of actions. Each of the two changed location boxes had a unique opening demonstration associated with it. Certain actions were termed '*arbitrary*', because they served no causal function in terms of opening the box. Other actions were termed '*causally-related*', because the action itself was functionally connected to opening the box even though it was not the most efficient way to do so (that is, for each action, the outcome could be more efficiently achieved by hand). Opening demonstrations incorporated both arbitrary and causally-related actions, and involved the use of the tools associated with each box.

Table 1
The puzzle boxes used in experiments 1 and 2.

	Box	Pictures		Opening mechanism
		Box closed	Box open	
Not acted upon by child	Blue box			Small knob on front; hinged
	Purple box			Metal clasp in middle of front
Acted upon by child	Green switch box			Metal bear 'switch' pushed horizontally
	Wooden box			Top metal loop pushed upwards

2.1.2.4. Wooden box opening demonstration. Experimenter 2 deliberately chose one of the corresponding tools (green mallet or yellow drumstick) and picked it up by the handle end. She then placed the tool upside-down vertically onto the top of the box with the colored end making contact with the lid. The tool's handle was then used as a fulcrum to flip the tool from vertical to horizontal so that it touched the right side of the box lid, then the left side, then the right side again (arbitrary action). This was done in a slow, deliberate motion. Next, E2 turned the tool horizontally and slid one end between the metal hooks on the front of the box, using the tool to push the lid up on its hinges (causally-related action).

2.1.2.5. Green switch box opening demonstration. Experimenter 2 picked up either the orange or red stick and used the tool to tap the top of the box three times (arbitrary action). The tool was then used to slide the opening mechanism from left to right, causing the box to open (causally-related action).

2.1.2.6. Toys. In each condition, toys were counterbalanced across boxes and trials in order to guard against any behavior of the children being inadvertently linked to toy attractiveness. The toys were: 1) a red and yellow wooden castanet with a smiley face painted on its top, 2) a soft pink rubber toy chicken which produced flashing lights when bounced, and 3) a small bird finger puppet.

2.1.3. Procedure and conditions

Upon arrival, the child and parent were escorted to a warm-up room, whereupon the parent was given a consent form to sign and provided with further information concerning the child's participation in the study. Whilst in the warm-up room, the child was given a variety of toys (unrelated to the task) to play with and time to settle into the test environment, and become familiar with both experimenters. Once this process was complete, the parent and child were ushered into the test room. Parents sat on a small couch near their child during the session. Children were allocated into one of the following three conditions:

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2.1.3.1. Helping—Demonstrator absent. The general procedure was derived from a typical change of location false-belief task (Wimmer & Perner, 1983). The child was brought into the test room and directed to sit on a small cushion on a play mat. Experimenter 1 (E1) sat facing the child and presented him/her with the first initial location box, which was closed and contained a toy. E1 sat across from the child and said: "I have something to show you, look what I have in here". E1 then opened the box and removed the toy. She proceeded to play briefly with the toy and communicated to the child how much she liked it: "This is my favorite toy!" Next, E1 said: "I have to go now, but I'm going to leave my toy in this box". She then placed the toy back into the initial location box and closed it. As she opened the door and exited the room she turned to the child and said, "Oh! It looks like [E2's name] is coming!"

Experimenter 2 (the 'demonstrator') entered the test room, sat down next to the child, and proceeded to look inside the initial location box. She took out the toy and said, "Oh look at this! This is a cool toy!" In order to reduce the child's desire to play with the toy and in turn lessen the likelihood that they would attempt to get it out immediately for themselves, E2 offered the child a turn: "Do you want a turn?" If the child said yes, the toy was given to him or her to play with for approximately 30–60 seconds. If not, the experimenter said, "That's okay, I'll have a turn instead," and she played with the toy briefly. Next, E2 took one of the changed location boxes (with its lid open) out from a large covered box positioned behind her and placed it, and the tools associated with it, onto the play mat. The tools were positioned on either side of the box. E2 said, "I have to go and listen to something now, so I am just going to leave the toy in here". She then placed the toy into the changed location box and closed the lid facing away from the child. She then said: "Oh! Before I go, I'd better show you how to get the box open!" E2 then selected one of the two tools (counterbalanced across participants and conditions), and said: "Watch me carefully". She then proceeded to demonstrate to the child how to reopen the box, including the arbitrary and causally-related actions previously outlined. E2 looked at the child before performing each action. After the last action was demonstrated E2 again closed the box, said, "I'll show you one more time", and repeated the opening demonstration. After the final demonstration E2 said "Okay, now I've got to go and listen to my recorder," got off the play mat and left the test room.

E1 then re-entered the room, sat across from the child and looked unsuccessfully for the toy in the initial location box, saying to the child, "Oh where's my toy? I thought I left it in here!" If the child immediately went ahead and attempted to open the changed location Box, E1 said nothing further. If the child suggested (verbally or through pointing) to her that the toy was in the changed location Box, she said, "I've never seen this box before. Can you get my toy for me?" and slid the box and tools toward the child. This dialogue was used to avoid communicating any expectation that the child directly copy what was shown by E2. Once the child opened the box and retrieved the toy trial 1 was concluded. In order to transition into trial 2, E1 said to the child: "I'm going to put these boxes away now but I've got something else to show you," and she placed both the initial location box and the changed location box out of sight. She then got the second initial location box, opened it and took the toy out. From this point, the procedure was identical to trial 1, except that the boxes and tools changed.

2.1.3.2. Helping—Demonstrator present. This condition was identical to the Helping—Demonstrator Absent condition, except that after demonstrating how to open the changed location box, and saying "Okay, now I've got to go and listen to my recorder", E2 sat on a chair in the corner of the room. She put on headphones that were attached to a recording device, pressed a button, and remained in that position. This was done to evaluate the effect of social pressure on children's behavior. That is, E2 remained physically present and could observe the child's behavior, but because she was 'listening' to something she could not 'hear' the subsequent exchange between E1 and the child, thereby reducing any assumptions that she would help.

2.1.3.3. Direct demonstration. This condition was designed to incorporate the method of a standard overimitation procedure whilst maintaining as much conformity as possible to the study's general method. The process was identical to that of the Helping—Demonstrator Absent condition, however after the opening demonstration E2 slid the changed location box and tools over to the child and prompted him or her to open the box by saying: "Now it's your turn." Once the child successfully opened the box, E2 then re-closed the box and left the test room as E1 returned.

2.1.4. Coding

From footage recorded during testing, coding was conducted for the child's behavior in the presence of experimenter 1 for the helping conditions and in the presence of experimenter 2 for the Direct Demonstration condition. For each box children were scored according to whether or not they: 1) selected the same tool as the experimenter; 2) copied the arbitrary action; and 3) copied the causally related action. Combined across boxes, children could score between 0 and 2 on each measure (i.e., each is scored independently to create 3 independent variables). A second coder who was blind to the rationale and specific hypotheses of the experiment independently observed and coded 20% of the sample. Cohen's kappa scores for all scores were above .85 on all measures, an excellent level of agreement. Disagreements were resolved by consensus.

2.2. Results

Preliminary analyses showed that there was no effect of gender or demonstration order on any of the variables of interest. These are not considered further. With regard to tool choice, the vast majority of children followed the experimenter's selection, and there was no difference in this tendency across conditions, $F(2, 39) = .04$, *ns*, partial $\eta 2 = .002$.

In terms of production of the arbitrary actions, children in the Helping—Demonstrator Present ($M = 1.36$, $SD = .84$), Helping—Demonstrator Absent ($M = 1.35$, $SD = .93$) and Direct Demonstration ($M = 1.57$, $SD = .76$) conditions all performed similarly, $F(2, 39) = .30$, *ns*, partial $\eta 2 = .02$ (see Fig. 1). Reflecting this, the 95% confidence intervals for the mean production of arbitrary actions show considerable overlap across Helping—Demonstrator Present [0.82, 1.89], Helping—Demonstrator Absent [0.87, 1.84] and Direct Demonstration [1.13, 2.01] conditions.

In contrast, and contrary to expectation, there was a significant difference in production of the causally related action (using the tool to open the boxes) across conditions, $F(2, 39) = 5.06$, $p = .011$, partial $\eta 2 = .21$. Tukey HSD post-hoc tests indicated that children in the Direct Demonstration condition used the tool at higher rates ($M = 1.86$, $SD = .36$) than children in the Helping—Demonstrator Present ($M = 1.14$, $SD = .77$) and Helping—Demonstrator Absent ($M = 1.07$, $SD = .92$) conditions, $p = .013$ and $.006$ respectively (see Fig. 2). There was no difference between the latter two conditions. The 95% confidence intervals for the mean production of causally related actions for children in the Direct Demonstration condition [1.65, 2.07] did not overlap with those for the Helping—Demonstrator Present [0.70, 1.59] and Helping—Demonstrator Absent [0.54, 1.60] conditions. Notably, across conditions 39 of 42 children opened both boxes, indicating that the task goal was sufficiently transparent and achievable (children who did not use the tool opened the boxes by hand).

2.3. Discussion

If children encode causally irrelevant actions as ritualistic, they should use them even when pursuing something functional for someone else. This is what we found. Indeed, children did so at comparable

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rates to those who had an adult directly pass them the test apparatus in a structured, pedagogical environment. Surprisingly, this pattern did not apply in the Direct Demonstration condition, where children were more likely to reproduce the causally related actions. The purpose of the causally related actions was clearly identifiable; they provided access to the hidden toy, whereas the arbitrary actions lacked any intuitive causal connection to the outcome. Adoption of the arbitrary actions suggests children take 'the ritual stance', attributing a rationale of cultural convention for demonstrated actions rather than one based on the laws of physical causation (Legare & Souza, 2012, 2014). As such, when taken out of the 'do-as-I-do' pedagogical environment created in the Direct Demonstration condition, children could evaluate the actions in terms of their causal efficacy and use easier means (i.e., their hands). By this reasoning children do not bundle together sequences of actions that lead to a tangible outcome as being all ritualistic or all functional, but can section them from each other.

If this explanation has traction, that children encode arbitrary actions within a ritualistic framework, then arbitrary actions should be replicated irrespective of their position in the larger chain of actions. To test this, in experiment 2 an adult modeled the arbitrary actions after the box was opened and hence after the functional goal of the demonstration had been achieved. To provide an even stronger test of the ritual stance argument, we included a condition in which the redundant actions were relocated to after the box had been opened while the aim remained, as per experiment 1, to retrieve a hidden object for a "naïve" adult.

3. Experiment 2

3.1. Method

3.1.1. Participants and new experimental conditions

Forty-four children participated in this experiment (20 male and 24 female) at four years of age (M = 52 months, range = 49–59 months). Recruitment, apparatus, general procedure used and coding scheme were all identical to experiment 1. Children were assigned to one of the following three experimental conditions:

3.1.1.1. Direct demonstration. As per the Direct Demonstration condition of experiment 1, E1 first played with her 'favorite toy' then departed having placed it in the initial location box. E2 entered, played with the toy, sharing it with the child, placed it in the changed location box then demonstrated to the child how to reopen it, including the arbitrary

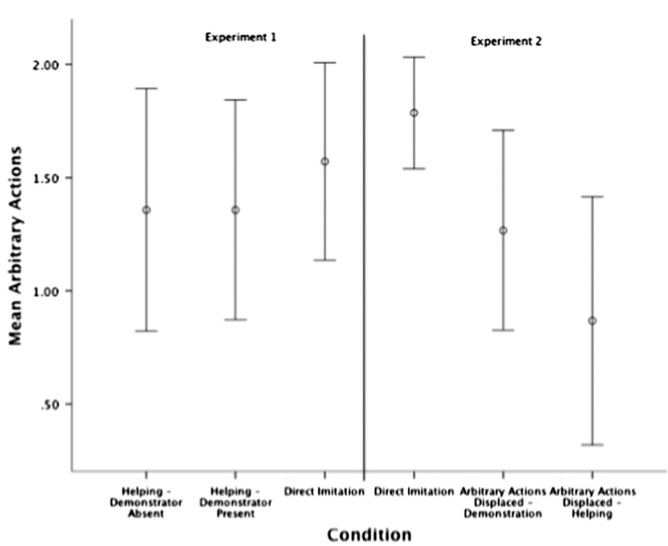

Fig. 1. Mean arbitrary actions and 95% confidence intervals for each condition in experiment 1 and experiment 2.

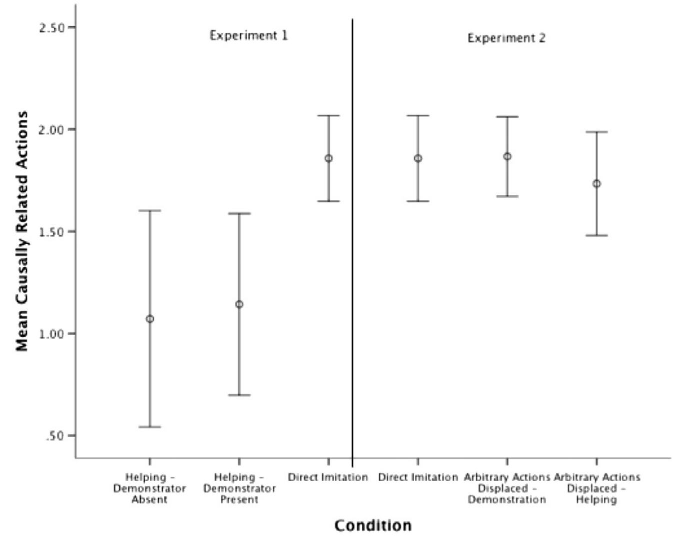

Fig. 2. Mean causally related actions and 95% confidence intervals for each condition in experiment 1 and experiment 2.

and causally-related actions previously outlined. After the last action was demonstrated E2 again closed the box, said, "I'll show you one more time", and repeated the opening demonstration. After the final demonstration E2 slid the changed location box and tools over to the child and prompted him or her to attempt to open the box, by saying, "Now it's your turn." Utilizing two experimenters in this way enabled direct comparison with experiment 1.

3.1.1.2. Arbitrary actions displaced—Demonstration. This condition was identical to the Direct Demonstration condition, except that the arbitrary actions were performed at the end of the sequence after the box had been opened. Thus, the demonstration order changed such that the model first picked up the target tool, used it to causally operate the box's opening mechanism, and then after the box was open and the hidden object accessible she performed the arbitrary actions on the open box. In this condition the arbitrary actions can in no way be interpreted as contributing to the goal of opening the box.

3.1.1.3. Arbitrary actions displaced—Helping. This condition was identical to the Helping—Demonstrator Absent condition of experiment 1 except that the arbitrary actions were performed after the box had been opened.

3.1.2. Coding

Coding was conducted from footage recorded during testing for the child's behavior in the presence of experimenter 1 for the Demonstrator Absent (arbitrary actions displaced) condition and in the presence of experimenter 2 for the Direct Demonstration conditions. As per experiment 1, for each box children were scored according to whether or not they: 1) selected the same tool as the experimenter; 2) copied the arbitrary action; and 3) copied the causally related action. Children could score between 0 and 2 on each measure.

3.2. Results

With regard to tool choice, as with experiment 1, the vast majority of children followed the experimenter's selection, and there was no difference in this tendency across conditions, $F(2, 41) = .19$, *ns*, partial $\eta 2 = .009$. Similarly, in terms of using the tool to open the boxes (causally related action), children in the Direct Demonstration (M = 1.86, SD = .36), Arbitrary Actions Displaced—Demonstration (M = 1.87, SD = .35) and Arbitrary Actions Displaced—Helping (M = 1.73, SD = .47) conditions all performed close to ceiling, $F(2, 41) = .53$, ns, partial

$\eta 2 = .03$ (see Fig. 2). Reflecting this, the 95% confidence intervals for the mean production of the causally related actions show considerable overlap across Direct Demonstration [1.65, 2.07], Arbitrary Actions Displaced—Demonstration [1.67, 2.06] and Arbitrary Actions Displaced—Helping [1.48, 1.99] conditions.

There was, however, a significant difference across conditions with regard to production of the arbitrary actions, $F(2, 41) = 5.03$, $p = .011$, partial $\eta 2 = .20$. Tukey HSD post-hoc tests revealed that children in the Direct Demonstration condition (M = 1.79, SD = .43) produced significantly more arbitrary actions than those in the Arbitrary Actions Displaced—Helping condition (M = .87, SD = .99), $p = .008$, with children in the Arbitrary Actions Displaced—Demonstration condition falling between (M = 1.23, SD = .80) but not being significantly different from either (see Fig. 1). Reflecting this, the 95% confidence intervals for the Direct Demonstration [1.54, 2.03] did not overlap those for the Arbitrary Actions Displaced—Helping [.32, 1.42] condition, with the Arbitrary Actions Displaced—Demonstration [0.82, 1.71] condition lying in between.

Notably, children in the Demonstrator Absent (arbitrary actions displaced) condition were exposed to the same demonstration as children in the Helping—Demonstrator Absent condition of experiment 1, except that here E2 modeled the arbitrary actions after the box was opened. Although rates of reproduction were lower in experiment 2 ($M_{Experiment\ 1} = 1.36$, SD = .93 vs. $M_{Experiment\ 2} = .87$, SD = .99) there was no statistical difference between the two conditions, $t(27) = 1.37$, *ns*.

3.3. Discussion

Any action performed once the goal of opening the box has been satisfied must be redundant. Given children's capacity for identifying causally necessary actions (Kenward et al., 2011; Keupp et al., 2013) it is unlikely they would have failed to recognize this. Yet those who saw such demonstration replicated arbitrary actions at similar rates to children for whom the same actions were embedded in a sequence leading to the boxes being opened. This suggests that preschool children, when shown actions having no apparent purpose, interpret them as holding non-causal significance.

Highlighting that children do not blindly copy everything, in the helping condition children produced the arbitrary actions at the lowest rate across experiments. The tendency for children to reproduce intentionally acted but causally redundant actions was reduced only by placing them after the functional goal had been achieved and when the actions were performed for someone else's benefit. Nevertheless, 6 of the 15 children in the current helping condition still reproduced the causally irrelevant actions on both boxes. This distinct manipulation dampened the overimitation effect, but could not extinguish it. We believe this emphasizes how children appraise modeled actions in terms of both functional valence and normative value, and make judgments on the relative value of each. For example, two recent studies have documented how children are highly motivated to copy actions of a group over those of an individual, but not when the group actions are unsuccessful (Turner, Nielsen, & Collier-Baker, 2014; Wilks, Collier-Baker, & Nielsen, in press). Precisely what directs and motivates children to assign proportional weight to functional and normative actions is beyond the scope of the current work, but is clearly something future overimitation studies need to address.

Finally, unlike experiment 1, children in the Arbitrary Actions Displaced—Helping condition used the tool to open the boxes (causally related action) at similar rates to those in the two direct conditions. It is possible that the lower rate found in experiment 1 was the outcome of a type I error. Against this, the rates of object use were similar for both helping conditions in experiment 1 and were similar for the three direct imitation conditions across both experiments. The standout difference is the lower rate of object use in the two helping conditions of experiment 1. It may be that seeing the functional actions demonstrated first amplifies the likelihood that they will be processed as causally necessary and less subject to cultural convention. Research is now needed to investigate this.

4. General discussion

Actions are readily ritualized when they are executed in a prescribed and deliberate manner, repeated to attract and hold attention, and which demote the importance of the goals such that performance is not necessarily associated with the achievement of some instrumental outcome (Legare & Herrmann, 2013; Rossano, 2012). The arbitrary actions employed in the current experiments neatly map onto these criterion. We thus maintain their reproduction should be seen in the context of children's adaptive inclination for tuning into, and for readily adopting, ritualized actions.

As previously noted, multiple interpretations of overimitation have emerged in recent years. The data from experiment 2 provide further evidence that accounts attributing this behavior to immature causal understanding lack broad explanatory power. Children reproduced the redundant actions even when the box was open and the contents easily retrievable. Any suggestion that children are confused about the causal connection between these actions and the target outcome are therefore either false (if the target outcome is viewed as getting the box open) or highly unlikely (if the target outcome is retrieval of the object).

In this context it is important to consider assertions that we are an “ultra-social” species (Herrmann, Call, Hernandez-Lloreda, Hare, & Tomasello, 2007, p.1360). Like no other animal, we are motivated to bind ourselves to those around us. We do this by showing we are like others and behave in similar ways so as to be liked by them, and we follow and reinforce behavior we think makes us part of our perceived in-group; perhaps because we consider members of our in-group to be ‘right’ and we want to show them that we think this (Haslam & Reicher, 2012). Under this umbrella are arguments that overimitation emerges from a need for social affiliation (Nielsen & Blank, 2011; Nielsen et al., 2008; Over & Carpenter, 2012, 2013) or as a normative act emerging through interpreting actions as essential parts of a bigger conventional, generic activity (Kenward, 2012; Kenward et al., 2011; Keupp et al., 2013). Experiment 1 indicates that overimitation does not arise solely to develop affiliation with the demonstrating adult, as children still overimitated when she was not present, but this need not diminish the explanatory value of this perspective. Indeed, both affiliation and normativity drive us to do just as others do, and in this sense these accounts can be seen as complementary and intertwined; both contributing to our motivation to act ritualistically.

Following what has become standard practice (e.g., Horner & Whiten, 2005; Keupp et al., 2013; Marsh, Pearson, Ropar, & Hamilton, 2013), here we treated only the replication of unnecessary steps (i.e., the ‘*arbitrary*’ actions) as overimitation. Given their heightened causal opacity relative to the arbitrary actions we chose the conservative approach of not treating the ‘*causally-related*’ actions as overimitative. But we could have as they constituted an inefficient approach to the task solution (as it is easier to use your hand to push the lid of the wooden box up and to slide the green switch box mechanism, rather than using a tool as demonstrated)—indeed past studies have done exactly this, albeit with younger populations (Nielsen, 2006; Nielsen et al., 2008). Though not considered here, the manner or style in which an action is executed may also constitute overimitation (Hobson & Lee, 1999; Lyons, 2009). This raises the issue of precisely how children identify actions as causally relevant elements of a given sequence and others as conventionally necessary yet causally irrelevant.

In experiment 2 the arbitrary actions were situated after the boxes had been opened. Similarly, children will copy an adult's redundant actions, including use of a tool to operate an opening mechanism, even after having discovered through their own trial-and-error learning simpler hand operations (Nielsen & Tomaselli, 2010; Nielsen et al., 2012). In both cases it seems highly unlikely that children would interpret the

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modeled actions as being causally important, and in situations where they are explicitly asked they will respond that such actions are indeed not necessary (Kenward, 2012; Kenward et al., 2011; Keupp et al., 2013). Nonetheless, we do not yet know how children decide if a particular action is causally necessary or not, or if certain kinds of actions (e.g., those involving unnecessary additional steps, inefficient means or unnecessary styles) are more 'normative' than others. Future research is needed to address this. Doing so promises to considerably illuminate our understanding of the overimitation phenomenon.

More than 5 million years of separate evolution divides us from chimpanzees, our closest living animal relatives. In that time we have evolved to be the highly overimitative species highlighted in the current experiments. Chimpanzees, on the other hand, do not overimitate (Horner & Whiten, 2005; Nagell, Olguin, & Tomasello, 1993; Tennie, Call, & Tomasello, 2006). Indeed it has been argued that it is not until around 1.75 million years ago when our hominin ancestors, including *Homo erectus* and *Homo heidelbergensis*, began striking large stone flakes and bifacially shaping stone tools to create the characteristic artefacts of the Acheulean industry that we see signs of a propensity for overimitation (Nielsen, 2012; Putt, Woods, & Franciscus, 2014; Shipton, 2010; Shipton & Nielsen, under review; although see Tennie, Braun, & McPherron, in press). From this period in our past the range and diversity of our tool kit began increasing exponentially alongside increasing group size (Dunbar, 1998, 2003; Vaesen, 2012). This likely created two distinct but complimentary pressures: (1) the need to obtain the necessary skills to use and make an increasing array of tools, and (2) the need to identify and bond to other group members, something that is facilitated by doing as others do. Overimitation serves both purposes, underscoring its emergence as a dominant learning process pivotal to the development of our species.

Rituals pervade the human condition, with astonishing variety, in ways that may grow communities and underpin human civilization (Jones, 2013). Here, in the behavior of young children we show how pervasive the inclination is to perceive actions as ritualistic, and adopt them as such. In a task that is novel, benign (failure affords no direct survival disadvantage), and minimally public (occurring in a closed test room with no bystanders present), young children readily reproduced actions with no functional valence. Their readiness to do so highlights the ease of uptake associated with ritualized actions and provides a window into the mechanisms by which they are passed from generation to generation. These experiments reveal the strong, early-emerging propensity of children for adopting the ritual stance. There are profound and enduring reasons for them to do so. It is what makes us human.

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