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COGNITION

Stick to the script: The effect of witnessing multiple actors on children's imitation

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A R T I C L E   I N F O

A B S T R A C T

What kinds of cues increase imitative fidelity in early childhood? The effects of multiple models and verbal framing were examined in preschool children (N = 259, 3–6-year-olds). Each participant was presented with one of eight possible combinations of type of modeling and verbal frame. The type of modeling involved: (i) a single model offering two demonstrations, (ii) two successive models each offering a single demonstration, (iii) two synchronous models each offering two demonstrations, or (iv) two synchronous models each offering a single demonstration. The verbal frame preceding the demonstrations emphasized either the instrumental outcome of the actions or their conventionality. Imitative fidelity was highest for the synchronous models (types iii and iv) and lowest for the single model (type i). Imitative fidelity was also higher for the convention-oriented than the outcome-oriented frame and higher for older than younger children. Children also provided more conventional explanations for their actions after viewing the synchronous models and after the convention-oriented framing. The results indicate that children's imitative fidelity depends on the number of actors and the way the actions are framed.

1. Introduction

Children use imitation to acquire both instrumental skills (Carpenter, Call, & Tomasello, 2005; Woodward, 2009) and social conventions (Churchland, 2011; Harris, 2012; Kashima, 2008; Kenward, Karlsson, & Persson, 2011; Over & Carpenter, 2012; Preston & de Waal, 2002) through a process of social learning (Tomasello, Carpenter, Call, Behne, & Moll, 2005). To be effective and efficient learners, children must be selective about when to imitate, when to innovate, and to what degree. Despite the vast literature on early imitation, little is known about how children use social cues to determine when the behavior of others provides an opportunity for instrumental vs. conventional learning.

Children are indeed instrumental imitators (Gergely, Bekkering, & Király, 2002; Want & Harris, 2002; Williamson, Meltzoff, & Markman, 2008) yet causal reasoning is not integral to all imitative behavior (de Waal & Ferrari, 2010; Heyes, 2009; Leighton, Bird, & Heyes, 2010). Beyond instrumental skills, children must also learn cultural conventions such as socially shared beliefs, values, norms, and practices (Harris, 2012; Kashima, 2008; Legare et al., 2012; Rogoff, 1990).

High fidelity imitation has been linked to core social concerns (Nielsen, 2006; Uzgiris, 1981), such as encoding normative behavior (Kenward, 2012; Kenward et al., 2011; Keupp, Behne, & Rakoczy, 2013), affiliation (Churchland, 2011; Kashima, 2008; Kitayama & Cohen, 2010; Over & Carpenter, 2012; Preston & de Waal, 2002), shared experience (Tomasello et al., 2005), and fear of

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ostracism (Lakin, Chartrand, & Arkin, 2008; Over & Carpenter, 2009). Much cultural learning in human societies is motivated by affiliative goals, resulting in the acquisition of social conventions rather than instrumental behavior.

There is evidence that even preschool children are able to adjudicate between situations in which social conventions are called for and those in which they are not. For example, they protest when the rules of a novel game are broken (Rakoczy, Brosche, Warneken, & Tomasello, 2009; Rakoczy, Warneken, & Tomasello, 2008) or social role conventions are violated (Carter & Patterson, 1982; Levy, Taylor, & Gelman, 1995). Moreover, children are sensitive to context when they evaluate actions and flexibly respond to variation in social information (Kavanagh, Suhler, Churchland, & Winkielman, 2011; Mesoudi, 2009; Rakoczy et al., 2009; Schmidt, Rakoczy, & Tomasello, 2011; Schmidt, Rakoczy, & Tomasello, 2012).

We propose that the psychological systems supporting the learning of instrumental skills vs. learning cultural conventions are facilitated by the use of two cognitive stances (i.e., interpretive modes). The first is an *instrumental stance* – seeking out a rationale for actions based on physical causation. The second is a *ritual stance* – seeking out a rationale for actions based on cultural convention. The key distinction between the instrumental and the ritual stances is not merely the presence of causal opacity (i.e., a physical causal rationale for the action is unavailable) but is based on the interpretation of the opacity. In the instrumental stance, the physical causal basis of an action is in principle knowable, even if it is currently unknown (as would be the case for novice learners). In contrast, in the ritual stance, the rationale is not in principle knowable from the perspective of physical causality Legare & Herrmann, 2013; Legare & Souza, 2012; 2013.

What distinguishes instrumental from ritual (i.e., conventional) practices often cannot be determined directly from the action alone (Humphrey & Laidlaw, 1994; Staal, 1990; Whitehouse, 2004) but requires interpretation by the learner based on relevant social cues and contextual information. For instance, the act of lighting a candle could be interpreted instrumentally (e.g., to find a lost object in the dark) or ritualistically (e.g., to commemorate an event or mourn a death). Where ambiguity in interpretation exists, learners may seek out cues to inform which psychological stance to adopt. We propose that instrumental and ritual interpretations are best understood as overlapping continua; in practice, the difference in perspective is often a matter of relative degree rather than kind.

Prior research has focused almost exclusively on children's imitation of a single model performing an action sequence (Carpenter et al., 2005; Lyons, Young, & Keil, 2007; Nielsen & Tomaselli, 2010; Schwier, Van Maanen, Carpenter, & Tomasello, 2006; Williamson & Markman, 2006). Yet children's social learning is sensitive to relations among individuals (Chudek, Heller, Birch, & Henrich, 2012; Chudek & Henrich, 2011; Nielsen & Blank, 2011) and particularly to whether two or more individuals act or judge in the same way (Corriveau, Fusaro, & Harris, 2009; Corriveau & Harris, 2010; Haun, Rekers, & Tomasello, 2012). Children conform to a group consensus in situations where no instrumental knowledge can be gained (Claidière

& Whiten, 2012) and disguise their correct opinions to conform to a group consensus (Haun & Tomasello, 2011).

In this study, we connect recent research on children's sensitivity to individuals who act in the same way to the large literature on imitation of a single actor. We presented all children with the same action sequence but sought to manipulate their stance in two distinct but related ways. First, we varied the verbal frame preceding a demonstration. The outcome-oriented frame was designed to trigger the instrumental stance whereas the convention-oriented frame was designed to trigger the ritual stance. Second, we varied the number of models that children saw (a single model vs. two models) and, in the case of two models, whether they acted in succession or synchronously. More specifically, children viewed one of the following four types of modeling: (i) *Single/Twice*: one single model demonstrating the action twice (for a total of two demonstrations); (ii) *Successive/Once*: two successive models each demonstrating the action once (for a total of two demonstrations); (iii) *Synchronous/Twice*: two synchronous models each demonstrating the action twice (for a total of four demonstrations); and (iv) *Synchronous/Once*: two synchronous models each demonstrating the action once (for a total of two demonstrations). For a more schematic representation of the types of modeling, see Fig. 2. Note that two synchronous conditions were included – Conditions (iii) and (iv) – in order to check whether synchrony or the total number of demonstrations affected imitative fidelity.

Each participant was presented with one of the eight possible combinations of frame and type of modeling. In order to investigate the possibility that children become increasingly sensitive to conventional information as they age (Yu & Kushnir, 2013), we conducted the study with children ranging from 3- to 6-years-old.

We predicted that children would engage in more faithful imitation of the demonstration when it was preceded by a convention-oriented verbal frame rather than an outcome-oriented one. We anticipated that the type of modeling would have a parallel effect. We predicted that children would engage in the most faithful imitation after watching two synchronous actors (Conditions iii and iv) and the least faithful imitation after watching a single actor (Condition i). This latter prediction was based on the assumption that seeing two people do the same thing at the same time is a strong indication that the specific form of the activity – the exact way in which it is performed – is regulated by convention.

Our interest in synchrony was motivated by evidence that many rituals involve synchronous actions (e.g., kneeling or clapping in unison) (Ehrenreich, 2007; Freeman, 2000; McNeill, 1995), and by research illustrating greater intragroup cooperation among people who participated in synchronous activity (Wiltermuth & Heath, 2009). Given that rituals and synchrony serve to bind groups together (Durkheim, 1915; Hove & Risen, 2009; Reddish, Bulbulia, & Fischer, 2013; Whitehouse, in press), if children show greater imitative fidelity after witnessing two synchronous actors than after two non-synchronous actors, this would suggest a conventional motivation for their imitation.

To further understand the impact of verbal framing and type of modeling on imitative behavior, we also asked

children to explain their actions. Explanations were coded for references to the constraints of convention vs. individual agency. We predicted that children would be more likely to provide explanations that referred to conventions than to individual agency following the convention-oriented frame, and also when they had watched two actors, particularly two actors in synchrony.

2. Methods

2.1. Participants

One hundred and twenty-eight 3-and 4-year-olds (65 female; *M* age 4 yr, 5 mn; range 3–4 yr 11 mn) and 131 5-and 6-year-olds (64 female; *M* age 5 yr 11 mn; range 5–6 yr 11 mn) were recruited from a university town in the American southwest. Participants were primarily Euro-American and from middle-class families. For the purpose of the analyses, children were divided according to their age groups into younger (3–4-year-olds) and older (5–6-year-olds).

2.2. Materials

The stimuli included six familiar shapes (used in the familiarization task), and a wooden mallet and pegboard (used in the imitation task). A laptop and a XX-inch display screen were used for presenting the stimuli in the familiarization task and the video demonstrations in the imitation task.

2.3. Design and procedure

Participants were randomly assigned to one of the eight possible combinations of verbal frames and type of modeling. The experiment consisted of three tasks: a familiarization task, an imitation task, and an explanation task. Each child participated individually in a quiet room.

2.3.1. Familiarization task

Children were shown stimuli to familiarize them with the video screen and the experimenter. The stimuli were presented using a Microsoft Office Power Point presentation of images, displayed on a screen connected to a portable computer. Children were shown a sequence of 6 pictures of objects and asked to indicate which pictures contained yellow stars (3 total).

2.3.2. Imitation task

Following the familiarization task, children watched videos of one or more actors interacting with the wooden mallet and pegboard in the exact same manner in each video. Fig. 1 displays the specific sequence. Children were allocated to one of the 8 combinations of frame (convention- vs. outcome-oriented) and type of modeling (Single/Twice; Successive/Twice; Synchronous/Twice; and Synchronous/Once). For the convention-oriented frame, the experimenter prefaced each video by saying, "She always does it this way. Let's watch very carefully. She always does it this way." For the outcome-oriented frame, the experimenter prefaced each video by saying, "She gets pegs up. Let's watch very carefully. She gets pegs up." In the Single/Twice condition, children saw the same actor using the objects twice. In the Successive/Twice, children saw two different actors using the objects one time each. In the Synchronous/Twice condition, children saw two actors seated next to each other acting on identical objects in synchrony twice. Finally, in a presentation designed to control for the number of interactions with the object seen across conditions, children in the Synchronous/Once condition saw two actors seated next to each other acting on identical objects in synchrony only once (see Fig. 2).

As soon as the video presentation(s) ended, the screen was turned off and the monitor was removed from the child's view. The object presented in the video was placed in front of the child and the experimenter said, "See this here? Now it is your turn. Here you go." Participants were given no explicit instruction to imitate the actions in the video. They were given 60 s to interact with the object before it was moved out of reach, but kept within view.
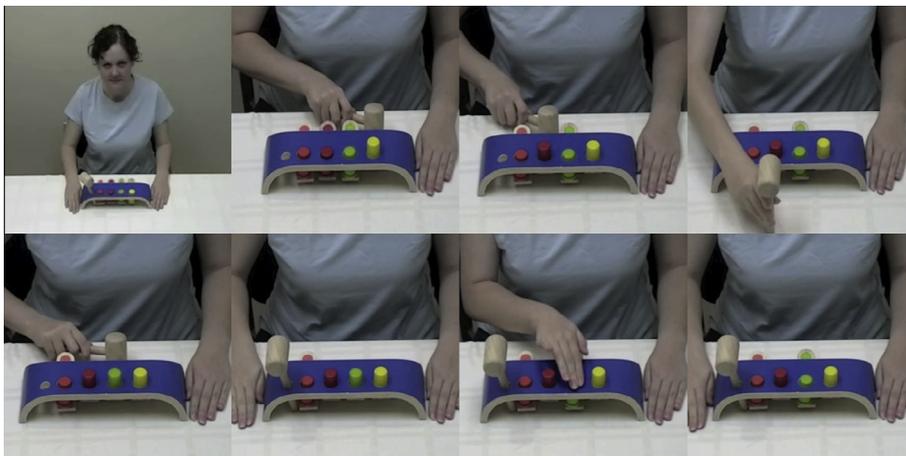

Fig. 1. The action sequence presented to children in each condition.

Single/Twice   Successive/Once   Synchronous/Twice   Synchronous/Once
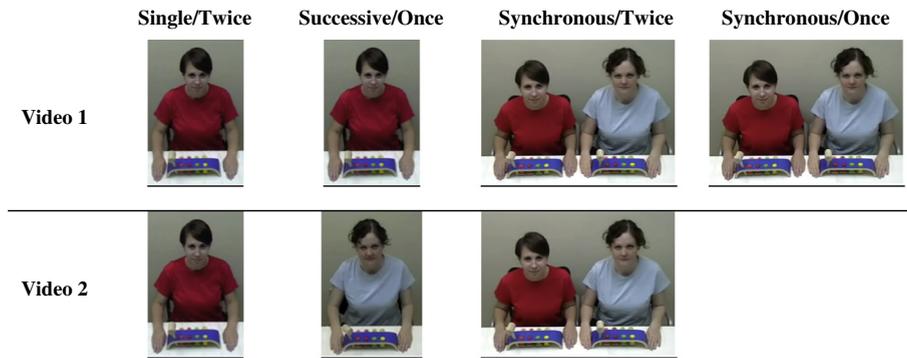
Video 1

Video 2

Fig. 2. Schema of the videos children saw for each type of modeling after each kind of frame (convention- vs. outcome-oriented).

2.3.3. Imitation coding

Children's actions were video recorded and fully transcribed. A coder blind to the hypothesis then coded transcriptions. They were coded for fidelity to the modeled actions. There were 6 different criteria for which children received either a score of 1 (imitating the demonstration) or a score of 0 (not imitating the demonstration): pushing the yellow peg up first, pushing the red peg up second, tapping the hammer third, pushing the green peg up fourth, pushing the green peg down fifth, and pushing the peg down with their hand. Each child's total number of points was calculated as a summary score out 6.

2.3.4. Explanation task

After completing the imitation task, the experimenter first asked the child, "Did you do it just the same way as they did it, or did you do something different?" Depending on the child's response to this initial question, the experimenter asked one of two follow-up questions, "Why did you do it the same way?" or "Why did you do something different?".

2.3.5. Explanation coding

Each child's response to the same/different question was coded as "same", "different" or "no response". Each child's response to the follow-up question was coded into one of three distinct categories: *Agentive Explanations*, *Neutral Responses* and *Conventional Explanations*. *Agentive Explanations* referred to the child's own desires (e.g., "Because I can do it anyway I want to"). Descriptions of concrete actions (e.g., "I used the hammer"), and references to uncertainty (e.g. "I don't know"), were coded as *Neutral Responses*. Finally, *Conventional Explanations* referred to a socially prescribed behavior (e.g., "Because I have to do what she does"). Data from children who failed to provide any response at all were not included in the analyses of the explanation data. Responses to the same-different question and the follow-up explanation question were then looked at in conjunction.

Inter-rater reliability was established using a randomly selected sample of 25% of the explanations. Kappas for the imitative fidelity score (88% agreement), and the explanation data (90% agreement) fall within near perfect agreement (.81 and above) levels (Landis & Koch, 1977).

3. Results

3.1. Imitation task

To investigate the effect of verbal frame and type of modeling on the fidelity of children's imitative behavior, as well as age-related differences, we ran a three-way ANOVA with verbal frame (2: convention-oriented and outcome-oriented) and type of modeling (4: Singe/Twice; Successive/Once; Synchronous/Twice; Synchronous/Once), and age (2: younger and older children) as between subjects variables, and imitative fidelity as a dependent measure. Results revealed a main effect of verbal frame $F_{(1, 258)} = 10.88$, $p < .01$, $^2 = .14$, a main effect of type of modeling, $F_{(2, 258)} = 13.38$, $p < .001$, $^2 = .04$ and a main effect of age, $F_{(1, 258)} = 18.46$, $p < .001$, $^2 = .07$. There were no statistically significant interactions. Follow-up pairwise comparisons using the Bonferroni correction revealed that children engaged in greater imitative fidelity after the convention-oriented ($M = 3.71$, $SD = 1.74$) than the outcome-oriented frame ($M = 3.10$, $SD = 1.51$), $p < .01$. Children engaged in greater imitative fidelity after witnessing two successive actors in the Successive/Once condition ($M = 3.15$, $SD = 1.68$) than after witnessing a single actor in the Single/Twice condition ($M = 2.48$, $SD = 1.37$), $p < .05$. They also engaged in greater fidelity after witnessing two synchronous actors in the Synchronous/Twice condition ($M = 3.96$, $SD = 1.89$) as compared to the Single/Twice or Successive/Once conditions. Similarly, they engaged in greater imitative fidelity after witnessing two synchronous actors in the Synchronous/Once condition ($M = 3.89$, $SD = 1.29$ as compared to the Single/Twice or Successive/Once conditions, $ps < .05$. Imitative fidelity was equivalent whether children saw the synchronous actors perform the action sequence once (Synchronous/Once, $M = 3.89$, $SD = 1.29$) or twice (Synchronous/Twice, $M = 3.96$, $SD = 1.89$), $p = $ ns. Finally, older children engaged in greater imitative fidelity ($M = 3.77$, $SD = 1.87$) than younger children ($M = 2.98$, $SD = 1.32$), $p < .01$. The main effects of frame and type of modeling (collapsed across the two age groups) are illustrated in Fig. 3.

Although there was no reliable interaction between verbal frame and type of modeling, we conducted additional planned comparisons using the Bonferroni correction to examine the extent to which verbal frame impacted
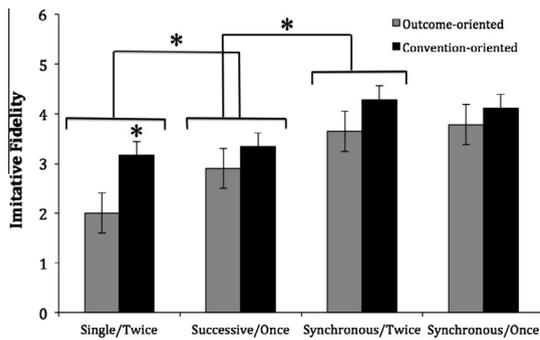
Fig. 3. Children's imitative fidelity after each frame and type of modeling, collapsed across age groups. Error bars represent SEM.

children's imitative fidelity in the four different modeling conditions. As shown in Fig. 3, children who witnessed a single actor in the Single/Twice condition showed greater imitative fidelity after the conventional frame ($M = 3.05$, $SD = 1.64$) than after the instrumental frame ($M = 2.00$, $SD = .91$), $p < .01$. There was no reliable effect of frame in any of the other three conditions.

3.2. Explanation task

The majority of children fell into one of two clearly distinct categories: 'same' followed by a conventional explanation or 'different' followed by an agentive explanation. See Table 1 for percentages of children's responses that were coded in the same/conventional and different/agentive categories. To investigate the impact of verbal frame, type of modeling, and age group on the kinds of explanations children provided, Chi-square tests were conducted. To analyze the effect of verbal frame, a 2×2 contingency table with verbal frame (convention-oriented vs. outcome-oriented) and type of explanation (same/conventional vs. different/agentive) was created. Verbal frame had a significant effect on the frequencies of explanation type, $\chi^2(1, N = 124) = 5.41$, $p < .05$. As shown in Table 1, the convention-oriented frame was associated with higher levels of same/conventional explanations, whereas the outcome-oriented frame was associated with higher levels of different/agentive explanations.

To analyze the effect of modeling, a 4×2 contingency table with type of modeling (Singe/Twice; Successive/Once; Synchronous/Twice; Synchronous/Once) and type of explanation (same/conventional vs. different/agentive) was created. Type of modeling had a significant effect on

the proportion of the two explanation types, $\chi^2(3, N = 124) = 8.28$, $p < .05$. As shown in Table 1, the proportion of same/conventional explanations increased, particularly between the Single/Twice condition and all others, whereas the proportion of different/agentive explanations decreased. An analysis of a 2×2 table containing type of modeling (Single/Twice vs. Synchronous/Twice + Synchronous/Once) and type of explanation (same/conventional vs. different/agentive) revealed a significant effect, $\chi^2(1, N = 92) = 7.75$, $p < .01$. Similarly, an analysis of a 2×2 table containing type of modeling (Single/Twice + Successive/Once vs. Synchronous/Twice + Synchronous/Once) and type of explanation (same/conventional vs. different/agentive) revealed a significant effect, $\chi^2(1, N = 124) = 4.63$, $p < .05$).

To analyze the effect of age group, a 2×2 contingency table with age group (younger vs. older children) and type of explanation (same/conventional vs. different/agentive) was created. A significant effect of age was found, $\chi^2(1, N = 124) = 6.95$, $p < .01$. In line with the greater imitative fidelity of older children, older children offered a greater proportion of same/conventional explanations (47%) than younger children (24%), and a lesser proportion of different/agentive explanations (53%) than younger children (76%).

4. Discussion

We propose that the human capacity for learning both cultural conventions and instrumental skills is supported by the ability to approach social learning from two stances – the ritual stance, based on the recognition of cultural conventions, and the instrumental stance, based on the recognition and achievement of instrumental goals. Our findings support the proposal that children bring both stances to social learning tasks, and flexibly switch between the two based on relevant social cues. The verbal framing of the action sequence and the way it was modeled had congruent effects on two distinct measures – imitative fidelity and the types of explanations produced.

The convention-oriented frame increased the likelihood that children would take a ritual stance as indexed by both measures. First, children were more likely to reproduce the exact action sequence. Second, they were more likely to indicate that they had engaged in the same action sequence and to provide conventional explanations, implying that what they did was prescribed (e.g., "I had to do

Table 1
Percentages of same/conventional and different/agentive explanatory categories in each of the eight conditions.

Modeling	Frame	Same/conventional (%)	Different/agentive (%)	Total explanations
Single/Twice	Outcome-oriented	14	86	21
	Convention-oriented	26	74	19
Successive/Once	Outcome-oriented	30	70	17
	Convention-oriented	53	47	15
Synchronous/Twice	Outcome-oriented	33	67	12
	Convention-oriented	56	44	9
Synchronous/Once	Outcome-oriented	39	61	18
	Convention-oriented	69	31	13

it how they showed me" or "I had to do it the way they did it").

By contrast, the outcome-oriented frame increased the likelihood that children would take an instrumental stance – also reflected in both measures. Children were more likely to ignore the exact sequence of demonstrated actions, to indicate that they had engaged in a different action sequence and to provide an agentive explanation that emphasized their own independent agency rather than any obligation to do what they had seen (e.g., "I can do whatever I want" or "I wanted to do it the way I did it"). The congruence between the two measures – one based on action, the other based on children's retrospective verbal accounts – strengthens our claim that the verbal frame altered children's underlying orientation toward the action sequence.

Evidence for congruence between the two measures and for the existence of the ritual and instrumental stances was also evident in the impact of the type of modeling.

When children watched two actors, especially two synchronous actors, rather than a single actor, they displayed greater imitative fidelity. Parallel findings emerged for the explanation data. Children were more likely to articulate the need to abide by convention when they had seen two actors, and notably two synchronous actors. Conversely, children were more likely to deviate from the action sequence and to offer explanations in terms of their autonomous agency when they had seen a single actor. Based on these results, the presence of two actors, and especially two actors acting in synchrony, is as effective a cue to the conventional nature of an action, and to the ritual stance, as verbal testimony.

Why exactly does the observation of two actors, particularly two synchronous actors, increase the likelihood that children will adopt the ritual stance? Young children readily assume that the actions of individual agents are determined by the goals and beliefs of those individuals (Csibra, 2008; Kuhlmeier, Wynn, & Bloom, 2003; Onishi & Baillargeon, 2005; Rossano, 2012; Saxe, Tzelnic, & Carey, 2007; Woodward, 1998). On this assumption, the specific movements of any two agents would not be expected to fully coincide. Thus, even if each agent is pursuing the same goal, their different starting points and different beliefs would rarely lead them to adopt identical paths or procedures to obtain that goal. Hence, occasions when two agents engage in the very same action are likely to be perceived as departures from ordinary goal-directed action, particularly if the physical-causal rationale is opaque. We speculate that when such uniformity is detected, children are disposed to ascribe it to social factors – more specifically, to norms regulating how each agent should act.

This line of reasoning has much in common with the rational action theory of imitation (Buchsbaum, Gopnik, Griffiths, & Shafto, 2011; Gergely & Csibra, 2003) in which children imitate an inefficient means of accomplishing a goal after witnessing an agent choose these means over more efficient ones. Both lines of research point to children's appreciation of cues that an action is conventional, and to their desire to faithfully imitate conventional actions. In the current study, the cues to convention were language, number of actors, and synchrony.

Perception of uniformity across agents – and the ascription of guiding norms – is feasible when two agents act in the same way in succession. However, the perception of uniformity – and the ascription of guiding norms – is likely to be enhanced when the two agents are side-by-side and acting synchronously. In such cases, the perception of uniformity does not require the encoding, retrieval, and comparison of individual action sequences. Uniformity is an immediately visible affordance. The increased ascription of guiding norms in the face of synchronous action is consistent with the ritual stance and with theories highlighting the importance of synchrony in ritual propagation (Wiltermuth & Heath, 2009).

We propose that the ritual stance facilitates the maintenance of the enormous variety in cultural practices found across human societies. In contrast, imitation of purely instrumental skills is less likely to lead to stable group differences because performance can eventually shift toward the most effective means of achieving a particular goal (Claidière & Sperber, 2010). However, source-based biases in imitation (Bandura, 1977) may be one factor that leads to stable group differences even in the methods used to achieve instrumental goals. Children's greater fidelity in imitating a method modeled by two actors over one modeled by a single actor is an example of such a bias.

Attention to social cues and contextual information is a key component of the development and transmission of cultural knowledge. The present findings show that children come to social learning tasks ready to interpret them flexibly as instrumental or ritualistic. Language and the type of modeling are two cues that sway children's imitative interpretation.

Author notes

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