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Why do children overimitate? Normativity is crucial

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ABSTRACT

Recent research has documented that children readily engage in *overimitation*, that is, the reproduction of causally irrelevant elements within a bigger action sequence. Different explanations have been put forward. Affiliation accounts claim that children overimitate to affiliate with the model. Causal confusion accounts claim that children mistakenly perceive causally irrelevant elements as causally relevant and, thus, imitate them. Normativity accounts claim that overimitation arises when children view causally irrelevant elements as an essential part of an overarching conventional activity. To test among these accounts, we had children watch a model produce some effect by performing a sequence of causally irrelevant and relevant acts, with the latter resulting in some effect. In two conditions, the model presented the action sequence as focused either more on the method or more on the goal, with the normativity account predicting that children should interpret the causally irrelevant element as essential more often in the method condition than in the goal condition. Three measures were used: (a) children's own overimitation, (b) their spontaneous responses to a puppet engaging in or refraining from overimitation, and (c) their explicit judgments about the puppet's behavior. Results revealed that overimitation was frequent in both conditions. In addition, however, children protested against the puppet only when she did not overimitate, they did so more in the method condition than in the goal condition, and they explicitly judged omission of the irrelevant actions to be a mistake in the method condition. These results

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are not readily compatible with affiliation and causal confusion accounts, and they speak in favor of normativity accounts.

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Introduction

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Imitation is a powerful and adaptive learning strategy that enables sophisticated forms of cultural transmission (Nielsen, 2012; Tomasello, 1999; Whiten, Hinde, Laland, & Stringer, 2011). The capacity to engage in systematic, rational, and flexible imitation is probably uniquely human and develops early in ontogeny (e.g., Barr, Dowden, & Hayne, 1996; Gergely, Bekkering, & Király, 2002; Meltzoff, 1988; Tomasello, Carpenter, Call, Behne, & Moll, 2005).

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Recent research has focused on a puzzling form of imitation that, at least on first look, does not seem to be adaptive at all—*overimitation*, that is, the reproduction of causally irrelevant action elements within bigger action sequences (e.g., Lyons, Young, & Keil, 2007). For example, if children witness someone operating an apparatus to retrieve some reward hidden inside and, during the process, the actor performs an obviously causally irrelevant Action A (e.g., tapping on top of the box) and a causally relevant Action B (e.g., opening the door of the apparatus), then children often reproduce both actions, A and B. Many studies have now documented this phenomenon, showing that it is probably uniquely human (Horner & Whiten, 2005), that it exists in different cultures (Nielsen & Tomaselli, 2010), that it emerges early in childhood and increases with age (McGuigan & Whiten, 2009; McGuigan, Whiten, Flynn, & Horner, 2007; Nielsen & Tomaselli, 2010), and that it occurs despite children's ability to explicitly distinguish relevant actions from irrelevant actions (Lyons et al., 2007).

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Different accounts have been put forward to explain this mysterious phenomenon. First, causal confusion accounts claim that children overimitate because they are confused about the causal status of the irrelevant action (Lyons, Damrosch, Lin, Macris, & Keil, 2011; Lyons et al., 2007). According to this account, when confronted with a model demonstrating an action sequence in an ostensive way, children automatically encode all elements of the actions as causally relevant, viewing the irrelevant act (e.g., tapping) as a causally necessary element of a bigger action sequence (e.g., retrieving the reward). For example, the children in the studies by Lyons and colleagues (2007, 2011) overimitated despite the experimenter's explicit instruction not to perform any "silly" actions (note that they had been given examples of such causally irrelevant "silly" actions, and could reliably distinguish them from relevant actions, during a warm-up phase). Children also continued to perform causally irrelevant actions under time pressure and in competitive situations. Despite the fact that performing the irrelevant actions meant wasting time and risking losing the game, children overimitated at high rates.

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Second, affiliation accounts claim that overimitation derives from children's attempt to affiliate with or be like the model (e.g., Over & Carpenter, 2012). According to such accounts, children are well aware that the irrelevant action element is causally irrelevant and not an essential part of a bigger action, but they perform it nonetheless to please or otherwise relate with the model. Evidence compatible with this position comes from studies showing that children are more likely to imitate a model when the model is socially responsive (Nielsen, 2006), that the absence of the model who had performed the irrelevant step decreases children's rate of overimitation (Nielsen & Blank, 2011), and that children who had first discovered by themselves an efficient method of how to retrieve a reward then switched to a more complicated method (including irrelevant actions) after a model had demonstrated this complicated method (Nielsen & Tomaselli, 2010).

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Normativity accounts, finally, view overimitation as based neither on causal confusion nor on affiliation with the model. Rather, the claim is that overimitation is based on children's general capacities for rational action parsing and interpretation and that it may occur when children interpret an action such that they consider the causally irrelevant element to be a part of the bigger overarching action sequence that they are imitating (Buchsbaum, Gopnik, Griffiths, & Shafto, 2011). In the case of generic conventional actions (e.g., soccer), some action elements (e.g., using one's *foot* to move the ball) might not be causally relevant to reach some end state (e.g., moving the ball behind the goal line), but they are

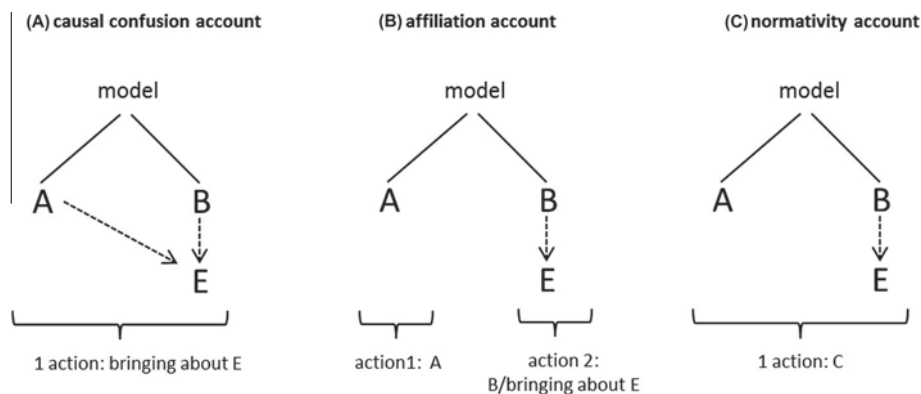


Fig. 1. Schematic depiction of the action parsing and interpretation underlying overimitation according to the three main types of accounts. The child sees the model perform Action A (e.g., tapping) and Action B (e.g., opening an apparatus) with Effect E (something is retrieved from the apparatus). According to the *causal confusion account*, the child parses the action sequence as one big action (bringing about E) of which A is a causally necessary element and reproduces the whole action, comprising A and B, under this interpretation. According to the *affiliation account*, the child parses the two steps, A and B, as separate and not inherently related but reproduces both A and B out of external social motivation to affiliate with the model. According to the *normativity account*, the child may be well aware that A is causally irrelevant for bringing about E but considers A and B essential parts of a bigger activity.

102 essential and obligatory parts of the activity (e.g., Kenward, Karlsson, & Persson, 2011; Rakoczy, Warne-
 103 ken, & Tomasello, 2008). Moving the ball behind the goal line by foot rather than by some instrumen-
 104 tally more effective means clearly is not considered irrational but rather simply playing by the rules.
 105 According to normativity accounts, thus, overimitation is not a nonrational phenomenon based exclu-
 106 sively on causal confusion or purely external social (affiliation-related) motivations but rather an indi-
 107 rect result of the way children rationally parse and interpret different types of actions. In contrast to the
 108 claims of affiliation accounts, thus, children perceive the causally irrelevant element as an essential
 109 part of the bigger action and not as some separate additional act. In contrast to the claims of the causal
 110 confusion account, children view the irrelevant element as a (conventionally) essential, even if causally
 111 irrelevant, part of a bigger action.

112 How can we test which of the accounts best explains a given form of overimitation?¹ Imitative
 113 behavior alone is inconclusive for this purpose. The basic reason is that imitation itself is ambiguous be-
 114 cause a child could imitate a given Action Element A in a sequence with Effect E under a variety of
 115 descriptions: “I want to bring about E, for which A is (causally) necessary, therefore I do it” (causal con-
 116 fusion); “I do A and B because she just did A and B” (affiliative); “I want to do C, A is part of C, therefore I
 117 do it” (normativity interpretation). Both the first and third accounts imply that the child perceives A as
 118 part of a bigger action. The crucial difference is that according to the causal confusion account, A is seen
 119 as a *causal* part of the bigger action—as causally necessary for bringing about E. According to the norm-
 120 ativity account, in contrast, A is perceived as an essential (in some cases normatively obligatory) part of
 121 the bigger Action C that might or might not be causally relevant (see Fig. 1 for illustration).

122 Additional measures, therefore, are needed to test among these accounts. One crucial measure is
 123 children’s spontaneous reaction, such as critique or protest, in response to third-party behavior, in
 124 particular to omissions of the action element in question. Such measures of spontaneous protest
 125 against a third party who does things differently have recently been used successfully as an indicator
 126 of normative action understanding in various domains (Casler, Terziyan, & Greene, 2009; Rakoczy,
 127 2008; Rakoczy et al., 2008; Schmidt, Rakoczy, & Tomasello, 2011; Wyman, Rakoczy, & Tomasello,
 128 2009; for a review, see Rakoczy & Schmidt, 2013). Another measure is children’s explicit judgment

¹ In general, the different accounts need not be mutually incompatible because there might be different forms of overimitation, each of which is better explained by different accounts. But for a given form of overimitation, the accounts can be tested against each other (see also Discussion).

129 of such third-party behavior, in particular whether children judge the omission of the causally irrelevant
130 act as mistaken. Explicit judgment of third-party actions has recently been used successfully
131 as another indicator of normative action understanding. And the two measures taken together—spontaneous
132 protest and explicit judgment—have been shown to produce highly consistent and convergent
133 findings at least from around 5 years of age onward (i.e., only if children protest against a certain
134 action do they explicitly judge it to be a “mistake”) (Rakoczy, Warneken, & Tomasello, 2009).

135 The three kinds of accounts, although not readily distinguishable regarding their predictions of
136 overimitation itself, make different predictions for the occurrence of protest and children’s judgments
137 in response to a third party *not* overimitating. First, according to causal confusion accounts, there is no
138 need to protest against someone who fails to perform an irrelevant Action A (or to call such performance
139 a mistake) as long as the person successfully brings about the designated Effect E. Second, with
140 regard to the affiliation accounts, why should a child protest against a third party for omitting an irrelevant
141 action (or call such behavior a mistake)? Affiliation accounts predict that the child alone overimitates,
142 but they do not necessarily predict that the child should expect and request others to do so.
143 Third, the normativity account is the only one to predict protest against someone omitting an Action
144 Element A and descriptions of such behavior as a mistake—in contexts where that element is perceived
145 by the child as essential to some bigger Activity C that the person is trying to perform. The first
146 evidence in favor of this account comes from a recent study finding that children criticize a third party
147 for failing to overimitate (Kenward, 2012).

148 The normativity account also implies that action interpretation is flexible and context specific and
149 that it guides children’s imitative responses. Much developmental research has documented such flexible
150 action interpretation and imitation; for example, infants and toddlers have been found to interpret
151 an action either as an unnecessary means or as an end in itself depending on the actor’s constraints
152 (Gergely et al., 2002) and as a function of the salience of a goal (Bekkering, Wohlschläger,
153 & Gattis, 2000; Carpenter, Call, & Tomasello, 2005). Depending on the model’s communicative refer-
154 ence to actions and their elements, children have been shown to shift their interpretation of an action
155 element from considering it essential to viewing it as superfluous and to imitate accordingly (Király,
156 2008; Southgate, Chevallier, & Csibra, 2009). Finally, depending on the context of action demonstra-
157 tion (playful vs. serious), children interpret and imitate the same actions differently (with more faithful
158 imitation of causally irrelevant elements in playful contexts) (Nielsen, Cucchiaro, & Mohamedally,
159 2012).

160 Regarding overimitation, the normative account highlights that different forms of (over)imitation
161 might occur under different circumstances. One crucial distinction is what type of action one consid-
162 ers. In the case of purely instrumental acts, the reproduction of a causally irrelevant action element is
163 superfluous—and, thus, the term *overimitation* is appropriate. In the case of norm-governed acts, how-
164 ever, the reproduction of a causally irrelevant, but normatively prescribed, action element is clearly
165 not superfluous—and, thus, the term *overimitation* would be a misnomer. Whether the reproduction
166 of an action element is superfluous or not, therefore, depends on both its causal relevance and its nor-
167 mative status. The normativity account can explain different forms of overimitation in slightly differ-
168 ent ways; what is common to all forms of overimitation is that it is based on an interpretation of the
169 perceived behavior as constituting a bigger Activity C consisting of Steps A and B. When the whole
170 activity observed is perceived as purely instrumental and A and B are (mistakenly) conceived as causally
171 connected (jointly causally necessary for bringing about Effect E), the child is causally confused
172 and overimitates because the child thinks instrumental rationality dictates the production of both A
173 and B when one wants to bring about E. In contrast, when the whole activity is perceived as conven-
174 tional and A and B are conceived as merely conventionally connected, the child has no such causal
175 confusion but thinks A and B need to be reproduced when one wants to perform Activity C because
176 they are essential conventional components of C. So in both cases, there will be overimitation. And
177 in both cases, there will be some normative responses toward third parties; the child will insist that
178 third parties need to reproduce A and B when trying to bring about E or perform C. But there is one
179 crucial difference that becomes apparent when the child witnesses that a third party can actually
180 bring about E without performing A. If the child conceived of the activity in question as purely instru-
181 mental (to bring about E) and had been causally confused, then she or he should now in fact have
182 learned something new (that A is not causally necessary for E), and now that the child’s causal

183 confusion has been amended, she or he has no reason whatsoever to protest against the third party's
184 omission of A. In contrast, if the child had thought of A and B as merely conventionally connected, then
185 witnessing that a third party can bring about E by only performing B should not change anything; from
186 the child's perspective, the third party is still making a mistake by omitting a conventionally necessary
187 part of the activity and, thus, should be criticized.

188 Against this background, the normativity account implies that the way an action is demonstrated
189 should affect how the child interprets it, and this in turn should affect the child's overimitation and
190 third-party protest. In particular, the more the focus of an action demonstration is shifted toward
191 the method of performing the action rather than on the action's instrumental effects, the more a causally
192 irrelevant Action Element A will be perceived as a conventionally essential and obligatory part of a
193 bigger Action C (see Fig. 1)—and, consequently, the more children normatively expect others to reproduce
194 this part ("This is the way this activity is performed correctly; it is part of the overarching goal
195 both to produce the effect and to produce it in this way") even if its causal irrelevance is obvious (for a
196 related line of argument regarding rational imitation, see Király, Csibra, & Gergely, in press).

197 To test this prediction, we varied the context of the action demonstration by linguistic and other
198 means, contrasting a goal-oriented instrumental context (focused on bringing about Effect E) and a
199 means-oriented conventional context (focused on the whole action chain). Children in the age range
200 typically investigated in overimitation studies (3–5 years) were tested. We measured children's own
201 (over)imitation, their spontaneous responses to a third party performing/omitting the irrelevant action,
202 and their explicit judgments of such actions as appropriate or mistaken. The normativity account,
203 in contrast to the alternative accounts, predicts that children should protest against third-party omissions
204 of the irrelevant action element and call such behavior mistaken and that they should do so more
205 in the means-oriented condition.

206 **Method**

207 *Participants*

208 Participants were recruited from a local database of parents, who had volunteered to participate in
209 child development studies, and were from mixed socioeconomic backgrounds.² Data of 48 3-year-olds
210 ($M = 40$ months, range = 36–45, 23 girls and 25 boys) and 47 5-year-olds ($M = 59$ months, range = 57–63,
211 25 girls and 22 boys) were included in the final sample. An additional 7 children were tested but
212 excluded due to technical/experimenter error ($n = 5$) or uncooperativeness ($n = 2$).

213 *Design and materials*

214 Each child played three games consisting of a main apparatus on which goal-relevant actions were
215 performed and a physically disconnected part on which irrelevant actions were performed. All games
216 were designed to be equally intuitive and causally transparent (see Fig. 2 for details). In a between-
217 participant design, children were randomly allocated to one of two conditions: the method condition
218 or the goal condition (see below). The order of games was counterbalanced across children and
219 conditions.

220 *Procedure*

221 First, there was a warm-up phase; the main experimenter (E1), a puppet (operated by E2), and the
222 child played together, engaging in three games: a puzzle, a stacking board, and an animal-matching
223 game. Throughout, the puppet made some mistakes (e.g., trying to fit a puzzle piece into the wrong
224 slot) in order to familiarize the child with the situation and encourage the child to interact with the
225 puppet and intervene when necessary.

² Socioeconomic status was not formally recorded, but children came from different day-care facilities in a mid-sized city that typically spans diverse socioeconomic backgrounds.




Game	Material	Relevant action	Irrelevant action	Effect
<p>Game A</p> 	Transparent box with an inclined transparent tube. Marbles were available and when thrown into the tube caused a bell to ring	The relevant action was simply to open the box, take out a marble and put it into the tube	A round box, physically disconnected from the main apparatus, had marbles stored inside. The irrelevant action consisted of tapping on the lid of this box with a stick before opening it and taking a marble.	Bells ring when touched by rolling marble
<p>Game B</p> 	Transparent box and a transparent tube; the tube functioned as a vertical marble "dispenser"	A long stick had to be inserted into the box at the bottom in order to push out the lowest marble in the dispenser on the other end of the box	There was a blue lid, physically disconnected from the main apparatus. The irrelevant action consisted of brushing the lid with a paintbrush (no paint!).	Toy mouse, who is waiting at the end of the box in her cage, gets a "cheese ball" (marble)
<p>Game C</p> 	Vertical marble dispenser at the upper end of an inclined plane	Four barriers that blocked the way had to be lifted one after the other in order for a marble to reach the end of the inclination	A little box, physically disconnected from the main apparatus, had a clock hand attached to it. The irrelevant action consisted of turning the clock hand manually.	Xylophone bars at the end of the plane provided the sound effect

Fig. 2. The three test games, including main apparatus and irrelevant parts.

226 The child then participated in the three test games, each with the same basic structure in both con-
 227 ditions (see Table 1). The only contrast between the conditions was in the focus of the action
 228 demonstration.

229 This contrast between means-oriented and goal-oriented demonstration was realized by combin-
 230 ing two factors known from previous studies to influence children's action interpretation: verbal
 231 labeling of actions (Király, 2008) and communicative context (Southgate et al., 2009).³ In the current
 232 study, our primary goal was to test *whether* such factors affect children's action interpretation, which
 233 then explains their differential overimitation and third-party protest, and that is why we did not system-
 234 atically vary the factors (which, however, will be an interesting question for future work). In the *means-*
 235 *oriented conventional condition* (the *method* condition), E1 first showed the child the main apparatus and
 236 which effect could be produced with it (e.g., a bell ringing). Then E1 announced she would show the child
 237 what else one could do; this demonstration included calling the game by a novel made-up name (e.g.,
 238 "daxing"), performing a sequence of irrelevant and relevant actions, and attaining the effect. These
 239 manipulations served to emphasize (a) that new information is being provided to help participants focus

³ The study by Király (2008) showed that infants reproduced irrelevant action steps (e.g., blowing a flower) less frequently in a condition where there was a verbal focus on a known instrumental end (e.g., "plant a flower") compared with a condition where the experimenter just stated that she was going to show something to the child. In the study by Southgate and colleagues (2009), children observed a model ostensibly attain an end state by a specific action style and imitated this style more often when they knew the effect (and so only the style was new for them) than when they did not (and both the style and effect were new for them).

Table 1
Schematic procedure and measures for the two conditions.

Phase of experiment	Condition		Measure
	Method	Goal	
Introduction	Prior demonstration of the game's effect	No prior demonstration	
Demonstration	Two demonstrations of the full action sequence (irrelevant + relevant action), e.g., "daxing"	Two demonstrations of the full action sequence (irrelevant + relevant action), e.g., "ringing the bells"	
Imitation Trial 1	Child is allowed to play the game for the first time		Imitative response
Third-party observation	Puppet plays the game twice (1× omitting, 1× performing irrelevant action), E1 asks child about correctness of puppet's actions right after each turn		Protest and explicit judgment
Imitation Trial 2	Child is allowed to play the game for the second time		Imitative response

240 on and identify the irrelevant step as part of the general activity and (b) that the activity stands in con-
 241 trast to the mere attainment of the effect and even has its own name, thereby stressing its conventional
 242 character. For example, after showing the child the ringing of the bell, E1 announced, "Now I'm going to
 243 show you something else—now I'm going to dax," and then performed the irrelevant action (e.g., turn a
 244 clock hand on a separate detached box) followed by the relevant action (e.g., lift some barriers to enable a
 245 marble to roll down an inclined plane) that produced an effect (e.g., the bell ringing). This full action
 246 sequence was performed twice.

247 In contrast, the demonstration phase of the *ends-oriented instrumental condition* (the *goal condition*)
 248 consisted only of the two demonstrations of the full action sequence without any prior exposure to the
 249 effect; and the action label used by E1 and the puppet simply referred to its effect (e.g., "ringing the
 250 bells"). That is, E1 started by saying, "Now I'm going to show you something—now I'm going to ring
 251 the bells," and then performed the sequence of the irrelevant and relevant actions leading to the action
 252 effect, as described above for the method condition.

253 In both conditions, after the second demonstration by E1, the child was allowed to play in her or his
 254 first imitation trial. At the start of the first imitation trial, E1 announced, "Now you can have a go and
 255 dax/ring the bells," and then turned away while pretending to be busy writing something down, there-
 256 by not attending to the child's behavior. After this, the puppet, who had been absent since the start of
 257 the game, returned and took two turns playing the game: including the irrelevant act on one of her
 258 turns and omitting it on the other turn (order counterbalanced across conditions and games). Each
 259 time she announced what she was going to do ("I am going to dax/ring the bells," depending on
 260 condition) before starting to act. As before, E1 was turned away and not paying attention. The puppet
 261 reacted in a neutral way to any protest utterances or explanations from the child, that is, acknowledg-
 262 ing that the child was explaining something but not reacting to it in a specific way. After each turn, the
 263 puppet announced that she had finished playing, E1 turned back to face the child and asked whether
 264 the puppet had played correctly (i.e., the explicit judgment question: "It was the puppet's turn to dax/
 265 ring the bell. Did she do it correctly or incorrectly?"). Finally, after the puppet's second turn, the child
 266 was allowed to play a second time herself or himself (second imitation trial), this time with the puppet
 267 present. Importantly, on this second imitation trial, the child got the chance to act after witnessing
 268 that the puppet's two turns had been equally successful in bringing about the effect (regardless of
 269 whether the puppet had included or omitted the irrelevant action). This procedure was repeated for
 270 each of the three test games. In general, children were given as much time as they needed to bring
 271 about the effect (usually less than 30 s). Only when E1 believed that the child had difficulties because
 272 she or he did not even touch the apparatus did E1 turn around after approximately 20 s and encour-
 273 aged the child to take a turn ("Did you dax/ring the bells already? It's your turn now. Go on, you can
 274 just give it a try—it's fun").

275 Coding

276 All sessions were videotaped and coded by a single observer.

277 *Overimitation*

278 Coding of overimitation was binary, looking at whether or not the child performed the irrelevant
279 action or an approximation of it (e.g., *knocking* on the irrelevant part with the brush instead of *brush-*
280 *ing*). This could happen either before or immediately after the relevant action. Children received
281 separate imitation scores for the first and second imitation trials.

282 *Protest*

283 Regarding protest, relevant interventions and utterances in response to the puppet's performing/
284 omitting irrelevant actions could fall into one of three hierarchical categories (Rakoczy et al., 2008):

- 285 • *normative* protest (child used explicit normative vocabulary to criticize the puppet, e.g., "No, you
286 must do it like this");
- 287 • *imperative* protest (child requested the puppet to act a certain way, e.g., "No! Knock here!"); or
- 288 • *hints* of protest (e.g., child used ambiguous language ("No!") or directed the puppet nonverbally to
289 an object that she did not use).

290 Both normative protest and imperative protest were considered clear signs of critique against the
291 puppet's behavior. The only difference lies in the vocabulary used by the participants, with explicit
292 normative wording providing the most unambiguous indication of calling out a normative transgres-
293 sion and, hence, being considered a hierarchically higher category.

294 Following the hierarchical coding scheme, each trial (i.e., each of the puppet's turns) then got as its
295 code the highest category code that had been observed (e.g., when all three types of protest occurred,
296 the trial got "normative protest" as its overall code).

297 Of specific interest was the timing of children's protest in the trials where the puppet did not
298 overimitate; protest against omitting the irrelevant action *before* the puppet brought about the effect
299 could theoretically be based on causal confusion, with the child assuming that the causally irrelevant
300 act was relevant and, thus, criticizing the puppet for failing to use a necessary means to an end. How-
301 ever, this is not the case for protest *after* the puppet has produced the effect. Therefore, we coded pro-
302 test separately for the whole trial and specifically only after the effect was brought about.
303

304 *Explicit judgment*

305 Coding of the explicit judgment was binary (correct/incorrect). Every child answered two questions
306 per game following each turn in which the puppet had performed/omitted the irrelevant action. This
307 yielded four possible answer patterns per game:

- 308 • child answered "wrong" when puppet omitted the irrelevant action and answered "correct" when
309 puppet overimitated (*overimitation pattern*);
- 310 • child answered the questions with the opposite pattern, that is, "wrong" after puppet's overimita-
311 tion and "correct" when puppet omitted the irrelevant action (*efficiency pattern*);
- 312 • child answered both questions with "correct" (*always "correct"*); and
- 313 • child answered both questions with "wrong" (*always "wrong"*).

314 Proportion scores for each of these categories are depicted below in Fig. 5 (see Results).

315 An independent reliability coder, blind to the hypotheses of the study, coded 25% of the data. Inter-
316 rater agreement was perfect for the imitation and explicit question variables and was very good for
317 the protest variable (linear weighed kappa, $\kappa = .92$).
318

319 **Results**320 *Imitation*

321 **Q2** The overimitation rate was high throughout the experiment (see Fig. 3). All children overimitated
322 at least once on the first imitation trial, and all but 1 child did so at least once on the second imitation
323 trial. For each child, the proportion of games in which overimitation occurred was computed across
324 the three test games. A 2 (Age Group) \times 2 (Condition) \times 2 (Imitation Trial) analysis of variance (ANO-
325 VA) on the proportion of games with overimitation only revealed a main effect of imitation trial, $F(1,$
326 $91) = 15.20, p < .001$, partial $\eta^2 = .14$ (for all other effects, $p > .05$), with the overimitation rate dropping
327 from the first imitation trial to the second imitation trial.

328 *Protest*

329 For statistical analysis, only protest episodes with clear forms of protest (i.e., normative or imper-
330 ative protest) were considered (the vast majority of such episodes [84%] consisted of normative pro-
331 test). For each child, the proportion of trials in which such protest occurred was computed across the
332 three test games (see Fig. 4). We first looked at differences in children's critique depending on the type
333 of trial the puppet was performing (performance vs. omission of irrelevant act), depending on age
334 group and condition. Then we analyzed children's protest against the puppet's omission of the act
335 in more detail.

336 First, protest occurred in 29% of trials (with roughly 50% of children protesting at least once) as a
337 response to the puppet *omitting* the irrelevant action, whereas children hardly ever protested in re-
338 sponse to the puppet *performing* the irrelevant action. A 2 (Age Group) \times 2 (Condition) \times 2 (Puppet's
339 Act: omitting vs. performing irrelevant act) ANOVA on the proportion of games with protest revealed a
340 main effect of puppet's act, $F(1, 91) = 61.72, p < .001$, partial $\eta^2 = .40$, an interaction of puppet's act and
341 age, $F(1, 91) = 5.18, p < .05$, partial $\eta^2 = .05$, and an interaction of puppet's act and condition, $F(1,$
342 $91) = 6.21, p < .05$, partial $\eta^2 = .06$.

343 Second, comparing protest against omitting the irrelevant action across conditions, a 2 (Condi-
344 tion) \times 2 (Age Group) ANOVA on the proportion of games with protest revealed only a main effect
345 of condition, $F(1, 91) = 4.22, p < .05$, partial $\eta^2 = .04$, with more protest occurring in the method condi-
346 tion, but no significant main effect of age, $F(1, 91) = 2.76, p = .10$, partial $\eta^2 = .03$, nor a significant inter-
347 action, $F(1, 91) = 1.73, p = .19$, partial $\eta^2 = .02$ (see Fig. 4A).

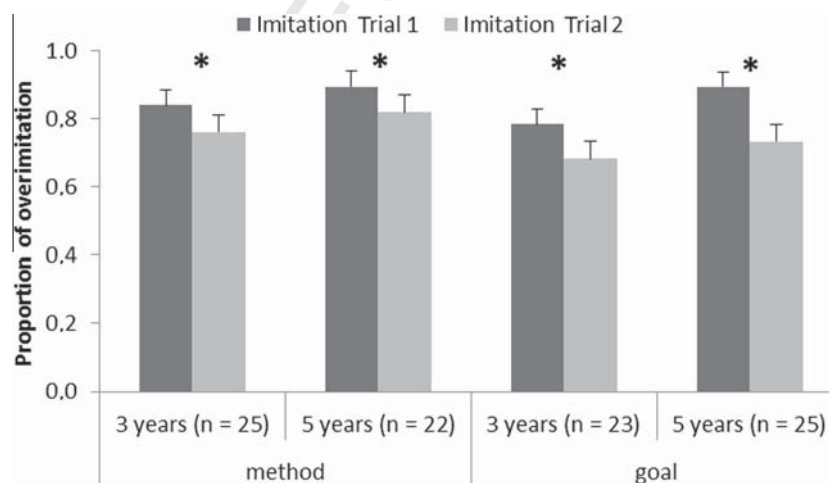


Fig. 3. Proportions of games (\pm SE) in which children overimitated in first and second imitation trials for the two experimental conditions.

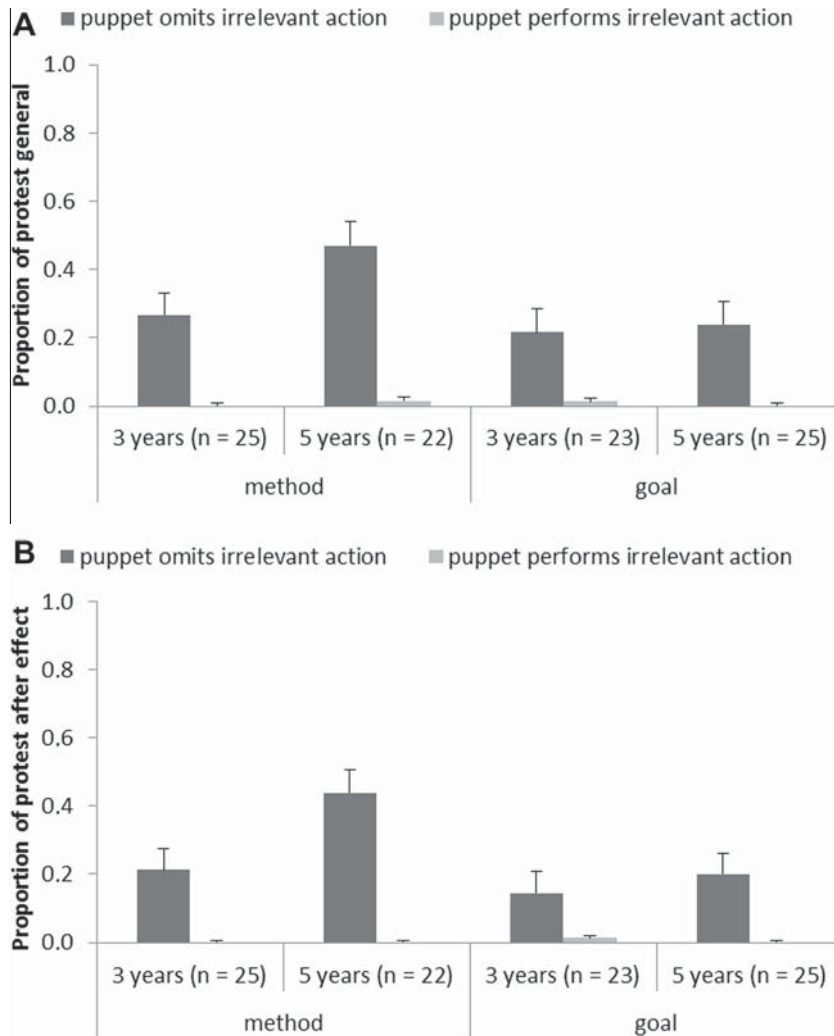


Fig. 4. Proportions of games (\pm SE) in which episodes of protest occurred in response to the puppet's performance as a function of age and condition. Panel A shows protest occurring throughout the whole trial, and Panel B shows protest specifically after children saw the puppet produce the effect.

348 In a more specific analysis, we took into account protest against omitting the irrelevant action only
 349 *after* the puppet had successfully produced the effect without the irrelevant action—because this form
 350 of protest indicates most clearly that protest could not have been based on causal confusion (Fig. 4B).
 351 The corresponding 2×2 ANOVA revealed a similar main effect of condition as the overall protest mea-
 352 sure, $F(1, 91) = 6.03, p < .05$, partial $\eta^2 = .06$, and a main effect of age, $F(1, 91) = 5.03, p < .05$, partial
 353 $\eta^2 = .05$, with no significant interaction, $F(1, 91) = 1.86, p = .18$, partial $\eta^2 = .02$.

354 *Explicit judgment*

355 Of special interest was the *overimitation answering pattern* (i.e., calling overimitation “correct”
 356 behavior and calling omission of irrelevant act “wrong” behavior) because this pattern reflects most

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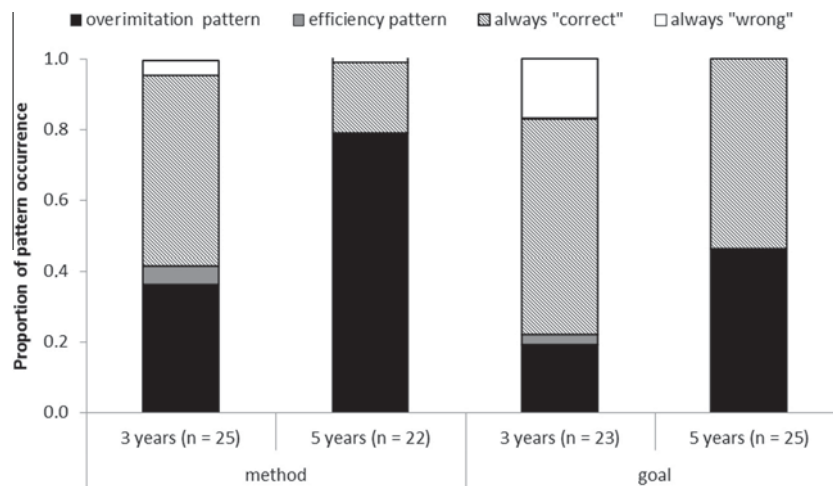


Fig. 5. Occurrence of the four possible answer patterns across age groups and conditions.

357 clearly children's conception of the irrelevant element as normatively obligatory. We first looked at
358 differences in general occurrence of this pattern, depending on age group and condition (see Fig. 5).
359 In a second step, we compared the experimental groups in more detail and then tested the occurrence
360 rate of the overimitation answering pattern against chance. Given the "forced-choice" nature of the
361 explicit judgment questions, we compared the observed data with a chance level of $0.5 \times 0.5 = 0.25$,
362 that is, with the probability to receive this answering pattern by guessing on each of the two ques-
363 tions. A 2 (Condition) \times 2 (Age Group) ANOVA with this pattern as the dependent measure revealed
364 significant main effects of age, $F(1, 90) = 18.95, p < .01$, partial $\eta^2 = .17$, and condition, $F(1, 90) =$
365 $9.74, p < .01$, partial $\eta^2 = .098$, with no significant interaction, $F(1, 91) = 9.74, p = .34$, partial $\eta^2 = .01$.
366 The older children expressed the overimitation pattern more often than the younger children, and
367 the pattern occurred more often in the method condition than in the goal condition. In a second step,
368 occurrence of the overimitation answering pattern was tested against chance level (25%) in the two
369 conditions. Results revealed that children showed this pattern significantly more often than expected
370 by chance in the method condition, $t(45) = 4.76, p < .05, d = 0.70$, but not in the goal condition,
371 $t(47) = 1.39, p = .17, d = 0.20$. Separate analyses for the two age groups showed that 5-year-olds per-
372 formed the pattern more often than expected by chance in both conditions [method: $t(21) = 6.43,$
373 $p < .05, d = 1.37$; goal: $t(24) = 2.45, p < .05, d = 0.49$], whereas there were no significant effects for 3-
374 year-olds [method: $t(23) = 1.35, p = .19, d = 0.28$; goal: $t(22) = -0.94, p = .36, d = -0.20$].

375 Discussion

376 To test among different accounts of overimitation, children were confronted with an action demon-
377 stration including a causally irrelevant element in either a method-oriented conventional context or
378 a goal-oriented instrumental context. Children's overimitation, their normative responses to a third
379 party performing/omitting irrelevant actions, and their answers to explicit questions about the third
380 party's actions showed a clear pattern: Children's rates of overimitation were very high in both con-
381 ditions and on both imitation trials (i.e., before and after witnessing a third party bringing about the
382 effect without the irrelevant element). Children spontaneously protested against the third party spec-
383 ifically when she omitted the irrelevant action but did not protest when the third party did overim-
384 itate, and children protested against omitting the irrelevant action more in the method condition than
385 in the goal condition. Finally, older children also explicitly stated that the puppet committed a mistake
386 when she omitted the irrelevant action (but not so when she overimitated) and did so more in the
387 method condition than in the goal condition.

388 Taken together, these findings are most compatible with the normativity account. First, although
389 the high rate of overimitation as such is compatible with all accounts, the high rate of overimitation
390 on the second imitation trial is not. Because children had just directly observed that the effect could be
391 produced successfully without the irrelevant action, overimitation on children's second imitation trial
392 is clearly incompatible with causal confusion accounts; once children have witnessed the causal irrel-
393 evance of the action element directly, the causal confusion should vanish and overimitation should
394 disappear.

395 Second, children's protest behavior in response to the puppet's lack of overimitation is easily ex-
396 plained by the normativity account; children's frequent protest behavior in the method condition sug-
397 gests that they saw the causally irrelevant Action Element A as a normatively binding, essential part of
398 a bigger conventional, generic Activity C—much like putting the ball in the mid-circle and blowing the
399 whistle at the beginning is not just an optional element of a soccer game. Children's behavior in the
400 goal condition suggests that they might have perceived the causally irrelevant Action Element A as
401 part of some Activity C (as indicated by their own overimitation), but not necessarily as an obligatory
402 and normatively binding part of a bigger conventional Activity C (as indicated by their lower rate of
403 protest in response to omission of A by a third party). Perhaps they understood C as a rather idiosyn-
404 cratic action sequence demonstrated by the model and still worth imitating—much like one under-
405 stands and imitates individual mannerisms of, say, soccer players, including their clearly irrelevant
406 dance moves after scoring a goal.

407 It should be noted, however, that children *did* sometimes protest in the goal condition as well—
408 even though the action of the model was introduced with an instrumental focus on goal achievement.
409 Even under such goal-oriented circumstances, thus, children can be led to assume that the way the
410 goal is brought about *does* matter and is regulated by a conventional norm—much like in other activ-
411 ities with both instrumental and conventional aspects (e.g., think of striking a goal in soccer where
412 there is a clear end of getting the ball behind the goal line but also a clear rule-governed means to
413 achieve this end, i.e., by foot or head but not by hand). Children in the goal condition might have
414 jumped to normative conclusions (too) quickly, reflecting the operation of what could be called “pro-
415 miscuous normativity”—similar to children's “promiscuous teleology,” that is, their tendency to jump
416 to conclusions about the functions of objects too readily (Kelemen, 1999). Under which circumstances
417 such promiscuous inferences (leading to potentially false conclusions, seeing norms where there are
418 not any) come into play is an important question for future research. One potential factor is ostensive
419 communication (when demonstrating an action) that—according to a recent proposal—leads children
420 to assume that what they witness embodies some forms of generic information (Csibra & Gergely,
421 2009; Király et al., *in press*; but see Schmidt et al., 2011, for evidence that ostensive communication
422 is not necessary for children's fast mapping of conventional norms).

423 Third, regarding the explicit judgments, the older children asserted that the puppet committed a
424 mistake when omitting the irrelevant action, but not so when she overimitated, and did so more in
425 the method condition than in the goal condition. This response pattern is consistent with the more
426 implicit protest measure and is easily explainable by the normativity account (but not by the causal
427 confusion or affiliation account). It is an open question why the younger children failed to answer
428 competently. Are these true negative findings? That is, did 3-year-olds, who mostly answered “cor-
429 rect” in response to the puppet's omission of the irrelevant action and to her overimitation, really con-
430 sider all actions equally? Alternatively, the explicit task, given its verbal demands, might have failed to
431 produce meaningful results with 3-year-olds and resulted in false negatives. The fact that children did
432 not discriminate between the overimitation and the lack of overimitation in their answers might sug-
433 gest that their performance pattern was based on some answer bias. This would actually fit, in general,
434 with much other research showing that 3-year-olds' action competence and their verbal competence
435 widely dissociate even in the very same domain and with regard to the same material (e.g., Rakoczy,
436 Tomasello, & Striano, 2006). More specifically, it would fit with previous studies on children's under-
437 standing of social norms showing that both 3- and 5-year-olds show competence in their spontaneous
438 protest against different types of actions (protesting against mistakes only), but only 5-year-olds show
439 the same converging pattern in their explicit judgments (Rakoczy et al., 2009).

440 All in all, the current findings on children's overimitation, protest, and explicit judgment support
441 the normativity account. They replicate and extend the work of Kenward (2012); children in both

442 studies expressed spontaneous critique of a third party not overimitating, thereby showing that nor-
443 mative considerations play a role in their imitation behavior. The current study extends these findings
444 by providing a consistent pattern of results across different variables and presenting a more system-
445 atic theoretical account to explain overimitation, including the acknowledgment of context sensitivity
446 and flexibility of action interpretation. In particular, as can be seen in the patterns of overimitation,
447 protest, and explicit judgment following different types of action demonstration, the current findings
448 suggest that (a) it seems to be conventional normative considerations—rather than unspecified instru-
449 mental or social reasons—that drive children’s protest and that (b) not all actions are automatically
450 coded as normative.

451 But might the alternative accounts, even though they seem to be *prima facie* unable to explain
452 these findings, be extended to cover the phenomena documented here? Causal confusion accounts
453 cannot readily explain overimitation on children’s second imitation trial (if children just saw that
454 the puppet brought about the effect without the irrelevant element, why should they still be causally
455 confused?) and protest behavior, in particular protest *after* the puppet brought about the effect. The
456 high rate of overimitation is especially striking and not in accordance with the predictions by Lyons
457 and colleagues (Lyons et al., 2011) with regard to the fact that in the current study the irrelevant ac-
458 tions were performed on objects that were physically disconnected from the main apparatuses. In
459 principle, the causal confusion account could be modified with regard to the hypothesized causal
460 structure and the nature of the causal effect. An extended version of the account might claim that
461 it is not a concrete observable effect about which children are causally confused (usually, in imitation
462 studies, something like a box opening or a light turning on) but rather some more abstract, less per-
463 ceptually accessible effect. This would be reminiscent of the magical (causally confused from our per-
464 spective) thinking sometimes involved in performing rituals where there are causal effects postulated
465 on gods, previous generations, and so forth (e.g., Bloch, 2008; Boyer & Lienard, 2006; Legare & Souza,
466 2012). Although it is a theoretical possibility that children in the current study postulated magical
467 causes, such an extension of the causal confusion account seems to be very far-stretched and has very
468 little plausibility to explain the current findings. The actions involved in our study bear little resem-
469 blance to typical rituals (where there is some direct reference to some transcendental subjects and/or
470 to some worldly effects desired (e.g., good health). And there is no independent evidence of any sort
471 that children entertain magical beliefs in scenarios like the one under study here. In general, however,
472 although not plausible for the current cases, the intimate relations of imitation, magical thinking, and
473 rituals in development are a very interesting, underresearched issue for future research.

474 In contrast to the causal confusion account, the affiliation account does predict overimitation on
475 both trials, but it fails to explain the protest and explicit judgment behaviors. If children perceive what
476 they see as separate actions that they reproduce out of affiliative motives, why should they care about
477 a third party’s ways of performing the action? Affiliation accounts could explain the current findings of
478 children’s protest behavior only with the amendment of an additional premise: Children not only
479 want to be like the model but also think that it is somehow generally obligatory that everyone else
480 should try to be like the model as well. Such a premise seems to be clearly *ad hoc* and unmotivated
481 by the account itself.

482 An interesting set of open questions for future inquiry concerns different kinds of normative con-
483 straints. The normativity account leaves open in which way Actions A and B are conceived as con-
484 nected and making up Activity C. In arbitrary rule-governed cases, the connection itself is
485 conventional and the norms are the social conventional norms governing the type of activity in ques-
486 tion. In other cases, however, the connection may well be causal, and the norms involved are then the
487 norms of instrumental rationality (if one wants to achieve an end, one ought to take the necessary
488 means). In the current study, the focus was on social norms governing—in fact constituting—conven-
489 tional activities (Searle, 1995) and thereby prescribing which elements to include in reproductions of
490 that type of activity. As a consequence, we were specifically interested in a critique against the lack of
491 overimitation. However, the normativity account implies that varying contexts engender different
492 kinds of rational and normative considerations ranging from purely conventional norms to norms
493 of instrumental rationality and efficiency. Both in contexts that are less conventional and in contexts
494 where the convention is to be efficient such as in competitive games (e.g., it is actually a norm viola-
495 tion in soccer not to try to win), rational and/or conventional norms push toward efficiency and, thus,

would justify the opposite patterns of protest—protest not against the omission but rather against the performance (overimitation) of causally irrelevant acts. How such different kinds of rationality constraints affect children's action parsing, interpretation, reproduction, and third-party sanctioning in different types of (over)imitation situations is another exciting open question for future research.

A third set of questions concerns the contexts in which different factors underpinning overimitation come into play. The current findings seem to conflict with accounts viewing the sole basis for overimitation in causal confusion or mere affiliation; instead, they suggest that under some circumstances—such as those in the current study—normativity assumptions seem to be key to explaining overimitation. Importantly, we do not claim that all forms of overimitation are best explained by the normativity account. Probably, overimitation is a multifaceted phenomenon that can have a plurality of cognitive foundations. Quite likely, for example, the less transparent the causal structure of the apparatuses is, the more likely causal confusion will become. And the more the focus is on social bonding, the bigger the role will be for factors such as mere social affiliation. What we need in future theory and research is a systematic pluralistic account and systematic data as to which factor underpinning overimitation plays which role under which circumstances.

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