Cognitive Development 57 (2021) 100999

Contents lists available at ScienceDirect

Cognitive Development

journal homepage: www.elsevier.com/locate/cogdev

Cultural affordances: Does model reliability affect over-imitation in preschoolers

Jedediah W.P. Allen *, Cansu Sümer, Hande Ilgaz

Bilkent University, Department of Psychology, Ankara, 06800, Turkey

ARTICLE INFO

Keywords:
Over-imitation
Selective trust
Social situations
Preschoolers
Reliability
Norm learning
Theory of mind

ABSTRACT

One general perspective on why children over-imitate is that they are learning about the normatively correct way of doing things. If correct, then characteristics of the demonstrator should be relevant. Accordingly, the current study aimed to investigate how the reliability of an adult model influences children's selectivity of what to imitate in an over-imitation situation (i.e., when some of the actions are causally irrelevant). Seventy-eight preschoolers between 3 and 6 years of age participated at school or in the lab on four tasks. A canonical trust paradigm was used to manipulate model reliability in terms of past accuracy. Children then watched *either* the reliable or unreliable model open a transparent box using the same relevant and irrelevant actions. In addition, children completed a standard ToM battery. Results indicated that children were more likely to over-imitate from a demonstration given by the reliable versus unreliable model. Children's ToM abilities were not related to their over-imitation behavior but showed some relations to their trust performance. Overall, the results provide support for a social situational approach to over-imitation that fits most closely with the norm learning perspective.

1. Introduction

Powerful forms of social learning are necessary for participation in human cultural practices. Broadly construed, social learning means learning from other people. There are two general categories of social learning that have become areas of focus for developmental researchers. The first is imitation and the second is selective trust. The emerging consensus from both areas is that these forms of social learning are necessarily selective (Mills, 2013; Over & Carpenter, 2012). Such selectivity applies to the *who*, *what*, *when*, and *why* of social learning processes. In general, imitation research has focused on *what* to learn ("Do I press this button or pull that lever?"), and, to a lesser degree, *why* to engage in imitation ("Is this important to know?", "Are we just having fun?"); while trust research was originally focused on *who* to learn from ("Is this person a reliable informant?"). Accordingly, when imitation researchers discussed the selectivity of social learning, they were mostly referring to children selecting what part(s) of the demonstration to copy and what part (s) to ignore (Gergely, Bekkering, & Kiraly, 2002). However, a direct influence on children's selections about what to copy, are the reasons *why* children imitate. Children can imitate for predominantly object-learning or social-engagement reasons (Over & Carpenter, 2012; Uzgiris, 1981). In contrast, when trust researchers discussed selectivity, they were more focused on who children selected as a trustworthy source of information (Harris & Corriveau, 2011).

Contemporary research has begun to integrate these different aspects of selectivity for both types of social learning (Koenig &

* Corresponding author.
E-mail addresses: jallen@bilkent.edu.tr (J.W.P. Allen), cansu.suemer@uni-due.de (C. Sümer), hande.ilgaz@bilkent.edu.tr (H. Ilgaz).

https://doi.org/10.1016/j.cogdev.2020.100999
Received 26 June 2019; Received in revised form 30 June 2020; Accepted 9 December 2020
Available online 28 December 2020
0885-2014/© 2020 Elsevier Inc. All rights reserved.

Sabbagh, 2013). For imitation, research has re-focused on the social purposes of imitation situations (Over & Carpenter, 2012). Social purposes can primarily involve engagement with another person but they can also involve learning about the culturally appropriate ways of ways of interacting with objects (Alessandroni & Rodriguez, 2017; Allen & Ilgaz, 2017; Király, Csibra, & Gergely, 2013). Part of the reason for the renewed interest in the social function of imitation comes from over-imitation research. The current study aimed to address the question of whether children's selectivity for what to imitate is influenced by the reliability of the model in an over-imitation situation (i.e., when the model demonstrates causally unnecessary actions).

1.1. Over-imitation

Over-imitation can be defined as the copying of *causally* irrelevant actions from a demonstration despite *clear* evidence that those actions are unnecessary to accomplish the task at hand. In their seminal study, Horner and Whiten (2005) compared chimpanzees and preschoolers trying to open either an opaque or a transparent artificial fruit box. For the opaque condition, the *causal* relevance of each step for opening the box was unclear. In contrast, when the box was transparent, some of the steps were clearly not *causally* relevant to open the box (e.g., stabbing a stick through a hole that could now be seen to just tap a false-ceiling for the chamber below). While both chimpanzees and preschoolers copied the *causally* irrelevant steps in the opaque condition, only the preschoolers copied those actions in the transparent condition. Not only did the chimpanzees look like more intelligent imitators than the preschoolers, but *infants* had previously been shown to demonstrate impressive selectivity in their imitation behavior (Gergely et al., 2002; Meltzoff, 1995). That said, infant's selectivity seems to disappear during toddlerhood which has led to some debate about the nature of why infants were showing selectivity in the original paradigms (Gergely, 2003; Huang, Heyes, & Charman, 2006; Paulus, Hunnius, Vissers, & Bekkering, 2011).

1.1.1. Over-imitation as byproduct of causal learning

There are a variety of specific accounts that purport to explain over-imitation. While there are meaningful differences between the accounts, they can be grouped into three families. The first of these is being characterized as the *physical-object* perspective. This label is used to capture the sense in which the perspective focuses on children gaining knowledge (learning) about the physical object (i.e., its causal structure) during an imitation situation. Further, proponents of this general perspective agree that social motivations are not responsible for over-imitation behavior. Instead, over-imitation is a byproduct of a mostly successful strategy to learn about artifact functioning. The opaqueness of how to use or construct artifacts means that imitation is, in general, a useful strategy (especially if children can 'copy-all' now and 'refine/correct-later'; Whiten, McGuigan, Marshall-Pescini, & Hopper, 2009). When children happen to copy causally irrelevant actions, they are acting inefficiently, but that only happens in a minority of cases (McGuigan, Whiten, Flynn, & Horner, 2007). Lastly, with the focus on the artifact as a physical object, it is the causal relations amongst the artifact's parts that are assumed to be learned (or mis-learned in the case of over-imitation; Lyons, Young, & Keil, 2007).

1.1.2. Over-imitation as byproduct of social motivations

The second general perspective is being characterized as the *social-engagement* perspective. This label is used to capture the sense in which the perspective argues that children are focused on social engagement that may involve different social motivations (e.g., to affiliate, to conform, etc.). From this perspective, over-imitation is a consequence of children possessing one of those underlying social motivations (Nielsen & Blank, 2011; Nielsen, 2006; Over & Carpenter, 2012). Accordingly, children are motivated to engage with the adult such that they copy with high fidelity irrespective of the content of what is being demonstrated.

1.1.3. Over-imitation as norm-artifact learning

The third general perspective is being construed as the *norm-artifact* perspective. This label is used to capture the sense in which children are learning about the socially constituted *normative* structure of the artifact. From this perspective, over-imitation is a consequence of children learning the socially *appropriate* way of using the artifact – how they *ought* to interact with the artifact (Kenward, 2012; Kenward, Karlsson, & Persson, 2011). Related research has demonstrated that preschool-aged children interpret games and other social activities with normative force (Rakoczy, Warneken, & Tomasello, 2008). Normative force implies that the criteria for success have a conventional/arbitrary aspect that is determined at the social level. Accordingly, what is necessary to succeed when using the artifact will include both the causally necessary actions but also the normatively "necessary" actions.

Recent work has provided overarching frameworks to contemplate and integrate results that support these different general approaches. In the first case, a review article by Hoehl et al. (2019) helps clarify the evidence for and against the three general explanations. The review of 54 different studies makes clear that over-imitation phenomena cannot fully be explained by causal reasoning but must incorporate social and normative mechanisms. Further, Nielsen (2018) has offered a theoretical integration of the different approaches that are ultimately grounded in the evolution of social motives. Specifically, the emergence of tool technology in the Acheulean period (approximately 1.75 million years ago) is argued to provide evidence for the presence a social motive to copy with high fidelity. In turn, this motivation enabled the evolutionary emergence of over-imitation which served as a crucial component in cumulative culture in general, but also in terms of the propagation of rituals more specifically.

1.1.4. Over-imitation as social-situation learning

Consistent with the growing evidence that, over-imitation involves both social and normative aspects, is a complementary perspective that highlights the social context within which the imitation activity takes place (Király et al., 2013). From this perspective, children's knowledge about the broader social situation influences *what* and *how* they learn from demonstrations. This approach could

be called the *social-situation* perspective. One version of this approach has argued that over-imitation is a consequence of the nature of learning to participate in social realities (Allen, 2012, Allen & Ilgaz, 2017). Social realities are constituted by mutually held interactive characterizations of the situation (e.g., a game of peek-a-boo, a birthday party, or a court proceeding) and constitute the basic social ontology for human culture (Christopher & Bickhard, 2007, Bickhard, 2008). Unlike interactions with physical objects, successful interactions with agents require a shared understanding about the type of situation that is involved. For example, if you think the current situation is a court proceeding and I think it is a game of peek-a-boo, you might recommend me to see a psychiatrist instead of granting bale.

Social realities will tend to be interpersonally learned, often times through imitation, but they will also tend to be culturally defined. The sociocultural nature of social realities means that children are learning the *culturally appropriate* way of participating in on-going activity amongst people. Imitation activity is itself a type of social reality, one in which children must learn how to learn from models (Allen & Ilgaz, 2017; Heyes, 2012). Initially, much of what is being learned involves the physical affordances of objects (Jones, 2007); however, this learning seems to include more social content during the second year (Nielsen, 2006; Uzgiris, 1981). Thus, for preschoolers, in addition to learning about any new *object affordances*, they are learning about the *sociocultural affordances* given the situation as a whole. That is, children are learning how people participating in a social reality interact with the object as a culturally constituted artifact (Alessandroni & Rodriguez, 2017; Rodriguez, 2007).

1.2. Epistemic opacity and trust research

As highlighted by the *norm-artifact* perspective, humans are inclined to adopt a normative stance toward socially learned demonstrations. This makes sense given the arbitrary/conventional aspects of successful social interactions (e.g., shaking hands vs. kissing cheeks to greet each other, which side of the road we drive on, etc.). However, in contrast to the norm-artifact perspective, the current approach suggests that the normative stance should apply to the social situation as a whole, of which the artifact is one aspect. Subsequently, the current approach does not argue for a motivational drive that compels humans to take a normative stance so much as a "motivation" for successful interaction that applies to interacting with objects as well as with people. That is, in contrast to a foundational motivation for norm-learning per se (or a prosocial motivation to cooperate with others), social "cooperation" is a necessary consequence of the nature of interacting with other agents (i.e., it is a consequence of the nature of social ontology as mutually held interactive characterizations). If the characterization is not mutual, then the interaction fails, and the two agents do not "cooperate". Accordingly, openness about the *way* of doing things with other agents will be important for successful cultural participation (e.g., while it doesn't matter which side of the road we all drive on, it does matter that we learn to do it the way it is supposed to be done). The need for these to be learned from other people explains the sense in which cultural affordances are epistemically opaque (i.e., you cannot discover them for yourself).

Other imitation researchers have used the concept of "opacity" to capture the limits of children's understanding about imitation demonstrations. However, the content of the opacity is typically on either the functioning of the object in terms of how object-transformations relate to an outcome (i.e., *causal-opacity*, Lyons et al., 2007; McGuigan et al., 2007), or, the functioning of the actions in terms of how they relate to the intentions of the demonstrator (i.e., *intentional-opacity*, Tomasello, Kruger, & Ratner, 1993). There are corresponding motivations related to each. For cognitive-opacity, the motivation for interacting is instrumental (i.e., to open the box), whereas for intentional-opacity, the motivation is affiliative/cooperative. Lyons (2009) has provided a comprehensive integration of the two types of opacity to explain the apparent contrast between selective- and over-imitation. Nielsen, Tomaselli, and Kapitány (2018) have also provided an integration of the two types of opacity. In particular, they argued that both are present in canonical over-imitation situations and are used by children as a cue to take the ritual stance (Legare, Wen, Herrmann, & Whitehouse, 2015). Rituals are conventionalized actions that involve repetition, redundancy, formality, and stereotypy. They are thought to have played an important role in culture and function to bind individuals into well-defined groups. The current approach is in general convergence with the ritual stance but suggests that over-imitation situations involve something broader than rituals. Further, the current approach would suggest that over-imitation situations primarily serve the function of learning about sociocultural norms and only indirectly serve the function of affiliation, conformity, or group cohesion. Accordingly, the current approach suggests that over-imitation situations in the preschool years is centered on *sociocultural-opacity*.

Trust research has taken the *sociocultural-opacity* of language as a starting point. Given the clear opacity of linguistic labels, children must learn to use characteristics about informants to guide their selection about what should be learned. For regular imitation, the demonstrator's success in the situation is itself an indicator of their competence for that activity (e.g., think about trying to prove your competence as a football star through words versus actions). For language however, children (and adults) must rely on other cues for competence (e.g., past accuracy) to make an attribution of reliability to the agent as a source of information more broadly. If over-imitation situations also involve *sociocultural-opacity*, then one should expect similar reliance on these other cues for learning about the situation. However, there is some indirect evidence to suggest that competence may not be as relevant a cue for who to learn from in the context of over-imitation. Research by Wilks, Kapitány, and Nielsen (2016) has demonstrated that children's preference to imitate successful individuals does not hold for causally opaque demonstrations (i.e., over-imitation situations).

Linguistic labeling and over-imitation are two areas of development that seem to require learning from competent and reliable social sources[1] . For regular imitation situations, the competence and/or reliability of the model is tied up with their success at the

[1] To clarify, competence reflects success or accuracy in a particular situation while reliability is the broader characteristic of the person as a source of information. Trust paradigms have been argued to reflect that latter (Einav & Robinson, 2011; Koenig & Harris, 2007).

activity (e.g., a professional footballer can show their competence/reliability through the demonstration itself). For over-imitation, however, the opaqueness of the causally irrelevant actions means that the actions themselves cannot be used to establish competence or reliability. That is, for over-imitation, children have little independent criteria to evaluate the demonstrator's success for those actions that are contrary to any "causal" information the child may have about the activity. Accordingly, as in the case of linguistic labels, children would be well-served to rely on *characteristics* of the model in order to establish who is a good source of information for learning about cultural affordance involving novel artifacts. Further, a comprehensive understanding of an informant as reliable versus unreliable will go beyond past behavior to include other facets of a situation that involve their psychological perspective on the situation. For example, a person who gives wrong information because they have been misinformed is not unreliable in the same way as a person who knowingly gives wrong information (Nurmsoo & Robinson, 2009). Accordingly, it can be expected that children's developing understanding of reliability may be influenced by their burgeoning theory of mind abilities.

1.3. Theory of mind (ToM)

For the developmental imitation literature, researchers have not typically explored the potential links between imitation and ToM abilities. One study that has measured ToM and imitation separately found no relationship between false-belief understanding and imitation of non-affordant tool selection (DiYanni, Nini, Rheel, & Livelli, 2012). Despite this finding, there may be a difference between regular imitation and over-imitation as they relate to ToM abilities (non-affordant tool selection may fall somewhere in between the two). Specifically, while the actions modeled during regular imitation have implicit intentional/cultural meaning, it would seem that in over-imitation the actions have explicit intentional/cultural meaning (i.e., the subject must have clear evidence that the action is not necessary which eliminates the causal meaning). Further, DiYanni and colleagues did not include other aspects of ToM beyond false-belief understanding and so a more comprehensive measure has been used in the current study.

1.4. The current study

The current study aimed to investigate how the reliability of an adult model influences children's selectivity of what to imitate in an over-imitation situation (i.e., when some of the actions are causally unnecessary). There are two main hypotheses: First, children will be more likely to over-imitate from a demonstration given by a reliable versus unreliable model. An effect of reliability would be most consistent with a normative learning perspective and least consistent with a physical-object learning approach. While an effect of reliability would not be inconsistent with a social-engagement approach, it is also not clear that an effect should be expected. The second main hypothesis is that children's over-imitation will be influenced by their ToM abilities such that those who copy more irrelevant actions will have higher ToM scores.

2. Method

2.1. Participants

Seventy-eight (40 male) predominantly middle-class Turkish preschool-aged children (range 2;10 – 6;6, M = 4;4 SD = 1;0) participated in the current study. Children were tested in their preschool (N = 59), in the university lab (N = 16) or at home (N = 3). Six additional children were excluded from all analyses (2 had help from a parent/brother throughout the session, 1 was bilingual and had difficulty speaking Turkish, 1 only spoke English, 1 was inconsistently participating and 1 didn't complete any of the tasks). Prior to testing, the approval of the institutional review board was acquired, informed consent was given by parents and child assent was taken on the day of testing.

2.2. Procedure

Children were tested individually in a quiet classroom in their preschool or in the university lab. The experimenter sat side by side with the participant facing the materials. Children were given stickers for their participation in the study. Four tasks were used during the testing session. First was a ToM task followed by a trust task, an over-imitation task, and finally a toy-preference control task. The ToM, trust, and toy-preference tasks were within-subjects while the over-imitation task was between subjects (reliable vs. unreliable model). A coder who was blind to the condition sat at the back of the room and recorded children's responses.

2.2.1. Theory of mind (ToM) task

Children's ToM abilities were assessed first. The ToM scale (Wellman & Liu, 2004) used for this assessment was adapted to Turkish by Özoran (2009) and was verified by our lab through translation and back translation. The scale included 5 sub-tasks that were administered individually to assess children's understanding that others can have psychological states that differ from the child's (i.e, psychological perspective-taking). Each sub-task involved a short scenario with pictures and a gender-match protagonist that were used to measure different aspects of children's psychological perspective-taking ability. The scale assesses whether children understand that others can have different preferences and desires than one's self (Diverse Desires; DD), that others can have different beliefs about the same object than one's own (Diverse Beliefs; DB), that others can have a false belief about the content of an everyday container (False Beliefs; FB), that others will be ignorant of information to which only the child has visual access (Knowledge--Ignorance; KI), and that others' actual feelings can be different than what they display on their face (Hidden Emotion; HE). For each

sub-task children received 1 if they answered the test question correctly and they received 0 if they answered incorrectly (total score 0–5).

2.2.2. Trust task

2.2.2.1. Accuracy familiarization phase. For the trust task, a laptop with PowerPoint (PP) software was used to display side-by-side videos of two informants. The models/actors in the PP videos were two Turkish speaking, college-aged, female fraternal twins. Throughout the videos, the models wore either a red shirt or a blue shirt, they faced forward, and they had a neutral expression. Each video was approximately 5–6 seconds in length. Each model was recorded individually. The models' shirt colors, their placement on the video screen as well as their accuracy in the accuracy familiarization phase and their toy preferences in the toy-preference control task were all counterbalanced.

The structure of the trust task paralleled existing research (Harris & Corriveau, 2011). To introduce the task, the experimenter pointed to the still-frame of the two models and said "See these two girls? One of them is wearing blue and one of them is wearing red. Now they are going to show you some things. I want you to watch them very carefully. Let's watch." Each model demonstrated either an accurate or inaccurate use of the familiar objects (see Table 1 for the accurate and inaccurate actions on the familiar objects). Children first watched the model on the left followed by the one on the right. All children received four separate trials with different objects. After each trial, the experimenter pointed to each model and said "The girl in the red shirt used the < object > like this, and the girl in the blue shirt used it like that. Which action do you think is correct?" Children received 1 if they reported that the reliable model used the objects correctly and they received 0 if they reported that the unreliable model used the objects correctly (total score 0–4). Regardless of their answer, children did not receive feedback form the experimenter.

Following the fourth accuracy trial, children were asked three evaluation questions about the models who were both on the screen. First, the experimenter pointed to the still-frame and asked "Did the girl in red shirt use the objects correctly or incorrectly?" Then, the experimented repeated this question for the other model. Next, children were asked "Which girl was better at using the objects?" Children received 1 for each question: if they reported that the accurate model used the objects correctly, that the inaccurate model to use the objects incorrectly, and that the accurate model was better at using the objects (total score 0–3). In addition, the experimenter reminded the children about the inaccuracy of the unreliable model by re-playing that model's last video, and said "Why do you think she did that? Was it because she was pretending or because she didn't know?"

2.2.2.2. Model endorsement phase. After the model evaluation questions, the experimenter pointed to the still-frame of a novel object and asked children whether they knew how the object was used. In cases where children claimed to know the function of the object, the experimenter said "Actually, I don't think that's how it's used. Let's watch how it's used". Then the experimenter played the videos one by one. In the videos, each model said "This is how it's used" and they each demonstrated an equally plausible action (see Table 2 for the actions on the novel objects). The experimenter pointed to each still-frame and said "The girl in red shirt used it for < Function A > and the girl in blue shirt used it for < Function B > . How do you think this object is used?" Either a non-verbal (e.g., demonstrating the function of the object or pointing to one of the still-frames) or a verbal (e.g., "What the girl in red shirt did") answer was accepted. Children received 1 if they chose the action that the reliable model performed and they received 0 if they chose the action that the unreliable model performed (total score 0–2) The actions that the two models demonstrated were counterbalanced.

2.2.3. Over-imitation task

For the over-imitation task, children were reminded about the past accuracy/inaccuracy of the model that would then show the child how to use a puzzle box. The puzzle box consisted of a 25 × 25 × 25 cm plexi-glass puzzle box with a latch and a wooden bar placed on the front with a perpendicular metal rod protruding out of the top (see Fig. 1). Children were shown a single power point slide of either the reliable or the unreliable informant with all four still-frames involving the actions on the familiar objects. The experimenter said "Do you remember that the girl in the red shirt used the pencil like this, the shoe like this, the jacket like this, and the toothbrush like this" by pointing at the each still-frame on the screen. Next, the experimenter pointed to a still-frame of the puzzle box and said "Now, that girl is going to show you how to open this box. Then you are going to have a go. Let's watch her carefully." Both informants demonstrated the same action sequence on the puzzle box. The model that children watched was counterbalanced.

With a neutral expression, the model said "This is how it's used". The model proceeded to remove the wooden bar (relevant), tapped it on top of the box three times (irrelevant), and pressed on top of the metal rod with her finger (irrelevant), unlocked the latch (relevant) and then opened the box doors[2] . The sequence was played twice. Regardless of the reliability status of the model, all children watched the same action sequence. Following this, the experimenter took out the physical puzzle box from where it was hidden, placed it in front of the child, and said "Now it's your turn!" If children were reluctant to do anything on the box for about 30 s or if they asked what they are supposed to do, the experimenter said "You can do whatever you want" in order to prompt the child. Once children opened the doors of the box, the experimenter asked the child to close his eyes, and the experimenter restored the box to its initial state. The experimenter then asked the child to open his eyes and gave the child a second chance with the box.

[2] Although children were near ceiling for opening the door, it is not part of their relevant-action score. The conceptual reason is that the action is not novel (i.e., using a knob to open a door is a canonical action for that outcome). The practical reason is that when the latch is pushed to the side the door sometimes seemed to drift open making it difficult to decide whether the child was opening the door as a distinct action or as part of undoing the latch.

Table 1
Actions for the familiarization trials.

Familiar objects	Accurate action	Inaccurate action
Beige boot	Wear on one's foot	Wear on one's arm
Pencil	Write on a piece of paper	Tap it on the table
Orange tooth brush	Brush one's teeth	Brush one's arm
Green jacket	Worn with the hood on the back	Worn it with the hood on the front

Table 2
Actions for the endorsement trials.

Novel objects	Function A	Function B
Black funnel-like object	Twirl in one's hand	Look through it
Blue & white water pump	Pressing and releasing	Turning the outer cylinder around its core

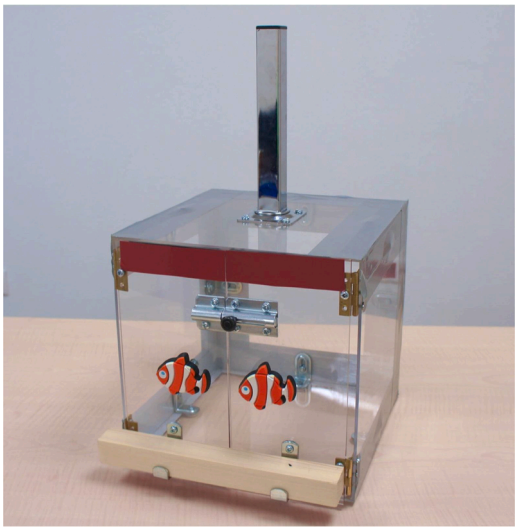

Fig. 1. The puzzle box used in the over-imitation task.

In each trial, only children's first four actions were scored, not including consecutive repeats (e.g., steps: 1, 2, 2, 3, 4 would be coded 1, 2, 3, 4). For each of the four steps that children performed they received 1 point. For the necessary actions, children could get a total score out of 2. For their unnecessary actions, they could get a total score out of 2. To ensure reliability of the coding, each session was recorded with a video camera and recoded back in the lab. One-hundred percent of the videos were recoded separately by an undergraduate student who did not know about the hypotheses of the study. Overall agreement between the original and recoded data was 90 %. In 6 % of cases it was clear that one of the two coders was correct while in the remaining 4 % of cases the ambiguity lead to a lab-wide discussion and final agreement. Only the particular actions were watched such that everyone providing input was blind to condition.

2.2.4. Toy-preference control task

Trust manipulations are not assumed to create halo-effects. Instead, the history of inaccuracy is interpreted as meaning you are unreliable as a source of new information (Einav & Robinson, 2011; Koenig & Harris, 2007). To confirm that the scope of the manipulation did not extend beyond the domain of learning, a toy-preference task was used (Zmyj, Buttelmann, Carpenter, & Daum, 2010). Children were shown a still-frame of two identical stuffed animal toys (orange vs light brown dragons) and the experimenter said "Look, there are two toys here. Let's see what the girls we've just watched say about these." The experimenter then played the videos of the models who looked at each toy, pointed to one of them, and said "I like this one." The photo of the toy they chose came up after each video was played. The preference of each model was the opposite of the other one. Children were then asked "Now you pick! Which toy do you like the most?" The toy choices were counterbalanced between the models.

3. Results

The analysis is divided into three sections. First, there is preliminary analyses related to the reliability manipulation itself. Second,

there is the primary analyses related to over-imitation and model reliability. Third, there is analyses for children's ToM performance as it relates to (over-)imitation.

3.1. Reliability manipulation check

Three one-sample *t*-test were conducted to determine whether children: 1.) correctly identified the accurate model; 2.) correctly evaluated which of the models was using the object properly/improperly; 3.) correctly endorsed the model who had previously been accurate versus inaccurate; (see Table 3 for percentage of correct responses). For all three test there are two options (chance equals 50 %). For all three tests, results indicated that children's preference was different from what would be expected from chance. Specifically: 1.) for identifying the accurate model ($t(78) = 17.68$, $p < .001$); 2.) for evaluating which of the models was using the objects (im) properly ($t(78) = 18.03$, $p < .001$); 3.) for endorsing the previously accurate model ($t(77) = 9.49$, $p < .001$). When asked why the inaccurate model was incorrect, the majority of children indicated that she "didn't know" (N = 70 %, see Table 3) as compared to "she was pretending". A chi-square goodness-of-fit analysis (chance = 50 %) indicated that children were significantly different from chance ($\chi^2(1, N = 74) = 15.1$, $p < .001$).

3.2. Does model reliability affect over-imitation?

The main purpose of the current study was to explore over-imitation activity as it relates to model reliability. In contrast to extant trust research, the design did not compare accurate and inaccurate models using a within-subjects design. Instead, each child saw *either* the accurate or the inaccurate model demonstrate how to open the box. For the imitation analyses, children were included if they showed an effect of the accuracy manipulation for the endorse questions (i.e., if children did not correctly select the accurate model to endorse, then they were not included in the imitation analyses). This selection criteria applied to a total of 13 children. Five additional children did not participate in this task (for 1, the laptop broke during the trust task; for the other four, they would not participate in the imitation task).

Two ANCOVAs were conducted to determine if children's imitation behavior (i.e., for relevant and irrelevant actions) was affected by the reliability of the model (i.e., the model's past accuracy). For both analyses, reliability was the between subjects variable, age was entered in months as a covariate, and the imitated actions were the dependent variable. For the relevant actions, there was no effect of reliability and age was marginal such that older children imitated more ($F(1,57) = 3.02$, $p = .09$; $\eta^2 = 0.05$). For the irrelevant actions, there was an effect of reliability ($F(1,57) = 6.80$, $p = .01$; $\eta^2 = 0.11$) such that children who watched the reliable model imitated more irrelevant actions than those who watched the unreliable model while controlling for age (see Fig. 2). Age showed a significant effect for children's imitation of irrelevant actions ($F(1,57) = 4.47$, $p = .04$; $\eta^2 = 0.07$) such that older children imitated more.

3.3. Is theory of mind related to social learning?

The mean score for the sample on the ToM scale was 2.43 ($SD = 1.14$). Ninety-seven percent of the sample scored in a range from 1 to 4. Bivariate and partial correlations between the ToM scale and (over-)imitation indicated no significant relations (see Tables 4 & 5). For ToM and trust, several bivariate correlations were present (see Table 4) but were mostly not observed after controlling for age (see Table 5).

Two sets of follow-up correlations were conducted between the same (over-)imitation and trust variables and the Knowledge-Ignorance (KI) and False Beliefs (FB) sub-tasks from the ToM scale. The reason for isolating these two sub-tasks was based on methodological and conceptual relevance. When past research has measured ToM in this context, it has typically meant false-belief understanding. Accordingly, to give the hypothesis of a relation between ToM and social-learning a thorough testing, it seemed appropriate to pull out the false-belief sub-task. The reason for analyzing knowledge-ignorance separately was based on what it measures. That is, it makes conceptual sense that children's understanding that others can be ignorant could be relevant for making judgments about the reliability of what others know (Robinson, Nurmsoo, & Einav, 2014).

Results indicated that for (over-)imitation there were no significant correlations with FB before or after controlling for age (see Tables 4 & 5). For trust, KI was correlated with 3 of the 4 questions before controlling for age (see Table 4). After controlling for age, KI was significantly correlated with being able to correctly identify the accurate model in the familiarization phase ($r = 0.32$, $p < .01$) and marginally correlated with correctly answering the evaluation questions about who had been correct versus incorrect after the familiarization phase ($r = 0.20$, $p < .10$).

Table 3
Average percentage of trials answered correctly by age.

	Recognition of Accuracy	Evaluation of Models	Endorsement of Models	Reason for Inaccuracy	
				Pretend	Ignorant
Total (n = 75)	94 %	92 %	84 %	30 %	70 %

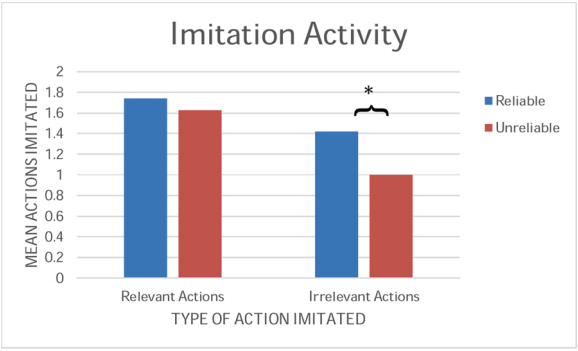

Fig. 2. Mean amount of imitation according to type of action and reliability condition.

Table 4
Correlations Between ToM, Imitation, and Trust Variables.

Variable	1	2	3	4	5	6	7	8	9	10
1 Age		.38**	.50***	.27*	.28*	0.19	.38**	.39***	.40***	0.13
2 ToM			–	–	0.14	0.02	.25*	.30**	.27*	0.18
3 -KI				–	0.12	0.11	.44***	.36**	.32**	0.09
4 -FB					0.06	−0.00	0.16	0.18	.20^{t}	0.18
5 Imitation Relevant						.26*	0.13	0.13	.23^{t}	−.25*
6 Imitation Irrelevant							0.03	0.08	−0.00	−0.15
7 Recognition of Accuracy								.34**	.28*	0.13
8 Evaluation of Models									.23*	0.14
9 Endorsement of Models										−0.02
10 Reason for Inaccuracy										

* $p < .05$.
** $p < .01$.
*** $p < .001$.
^{t} $p < .10$.

Table 5
Age-Partialled Correlations Between ToM, Imitation, and Trust Variables.

Variable	1	2	3	4	5	6	7	8	9
1 ToM		–	–	0.02	−0.05	0.12	0.17	0.13	0.14
2 -KI			–	−0.02	0.03	.32**	.20^{t}	0.14	0.04
3 -FB				−0.00	−0.06	0.07	0.10	0.12	0.15
4 Imitation Relevant					.23^{t}	0.14	0.05	0.11	−.26*
5 Imitation Irrelevant						0.04	0.05	−0.13	−0.16
6 Recognition of Accuracy							.24*	0.16	0.09
7 Evaluation of Models								0.07	0.10
8 Endorsement of Models									−0.07
9 Reason for Inaccuracy									

* $p < .05$.
** $p < .01$.
^{t} $p < .10$.

3.4. What is the scope of the reliability manipulation?

Past accuracy is not generally assumed to extend to domains where issues of reliability are not relevant so it was predicted that children would show no preferences in this task. A chi-square goodness-of-fit analysis (no preference = 50 %) was conducted to test whether children would select the toy preferred by the reliable model. Contrary to expectations, children showed an overall preference for the toy selected by the reliable model (N = 69 %, $\chi^2(1, N = 60) = 8.67, p < .005$). Given that children under the age of 4 sometimes show task-irrelevant preferences (Corriveau & Harris, 2009; Corriveau, Kinzler, & Harris, 2013; Harris & Corriveau, 2011), a chi-square test of independence was conducted to look at children younger versus older than age 4. It was expected that children would pick each of the toys equally, however, while the younger children were at chance, 76 % of older children selected the toy chosen by the reliable informant. Finally, this preference for the reliable informant did not change across conditions (i.e., N = 69.7 % in the reliable model condition and N = 70.4 % in the unreliable model condition, $\chi^2(1, N = 60) = 0.00$).

4. Discussion

4.1. Over-imitation as cultural affordance

The main purpose of the current study was to investigate issues of model reliability for over-imitation. If over-imitation is understood as involving the cultural affordances of artifacts, then issues of model competence and reliability should be relevant. For regular imitation, the competence/reliability of the model is directly available to the observer: if the model is not competent/reliable, then they will fail to achieve the goal and that will be transparent to the naïve observer. In contrast, for over-imitation, competence alone is insufficient to establish whether the causally irrelevant actions are being demonstrated by a reliable member of the culture or not. Accordingly, the results demonstrated that children over-imitated more often if the model had explicitly proved to be reliable versus unreliable in the past.

Issues of model reliability are well motivated for any approach that assumes over-imitation involves sociocultural opacity. Of the three general perspectives on over-imitation (*physical-object*, *social-engagement*, *norm-artifact*), the results would seem least congruent for the *physical-object* perspective (Lyons et al., 2007; Lyons, 2009; McGuigan et al., 2007). Specifically, if over-imitation is a byproduct of an evolved strategy to learn from others, then more nuanced issues of model reliability seem tangential. That is, if an adult's intentional actions elicit imitation at all (i.e., the mechanism has been triggered), then it should make little difference whether that adult has been reliable in the past or not. The overall fitness of the evolved mechanism is built on the idea that occasional mislearning is unproblematic and therefore neither would nuances related to avoiding such occasions of mislearning.

In contrast, the current results are most consistent with the *norm-artifact* perspective (Kenward, 2012; Kenward et al., 2011). The appropriate way of using artifacts is determined at the social level and this makes the reliability of group-members crucial. The difference between this approach and the social situation approach that is endorsed by the current study may largely be a matter of scope and underlying motivations. That is, any differences between the *norm-artifact* approach and the *social situation* approach may be more conceptual than empirical with respect to issues of model reliability.

Finally, the *social-engagement* perspective seems somewhere in between the other two (Nielsen & Blank, 2011; Nielsen, 2006; Over & Carpenter, 2012). This approach would seem to motivate the relevance of something like social-emotional reliability (i.e., consider having a reliable caregiver and the effect on attachment). However, trust manipulations are argued to concern issues of *epistemic* reliability (Einav & Robinson, 2011; Koenig & Harris, 2007) and thus it can be concluded that the results fit best with a generally normative perspective on over-imitation. That said, social-motivations are interconnected with normative motivations but in a less direct manner (i.e., the social aspect of normative motivations are derivative from their relevance for sociocultural participation). Further, a generally normative approach emphasizes that it is still the learning function of imitation that is most operative in over-imitation situations. In contrast, the *social-engagement* approach emphasizes the social-function of imitation for explaining over-imitation (Allen & Ilgaz, 2016; Uzgiris, 1981).

Ultimately, more theoretical and empirical work will be needed to integrate the growing literature that has demonstrated the flexibility (selectivity) of over-imitation behavior (Hoehl et al., 2019). Research has shown that there are cognitive, social-motivational, and social-cognitive influences on preschoolers' over-imitation behavior (Allen & Ilgaz, 2017; Burdett, McGuigan, Harrison, & Whiten, 2018; Clay, Over, & Tennie, 2018) and that culture is likely to be relevant for understanding these influences (Corriveau et al., 2017).

4.2. Social-cognition and social learning

4.2.1. ToM and (over-)imitation

There is limited data on measures of (over-)imitation and ToM abilities in the preschool years. The lack of correlations between ToM and (over-)imitation in the current study is consistent with DiYanni et al. (2012). One conclusion to draw from these null findings is that there are no relevant social-cognitive abilities related to (over-)imitation. However, social-cognition is broader than ToM and, therefore, ToM tasks may not measure the *relevant* social-cognitive abilities. In particular, there is a burgeoning recognition that much of human social-cognitive abilities need not involve mental-state attribution of the sorts captured by ToM tasks (Andrews, 2012; Allen & Bickhard, 2018; Carpendale & Lewis, 2015). Instead, social-cognition abilities related to understanding the normative structure of social roles and social situations may be more relevant for over-imitation related research (especially if over-imitation is itself best explained by a generally norm learning approach).

4.2.2. ToM and trust

Developments related to false-belief performance were originally thought to underlie the differential trust performance seen between three and four years of age (Koenig & Harris, 2005). However, subsequent studies have shown that 3-year-olds are capable of better than chance performance on a variety of trust measures. This suggests that selective trust may not *require* false-belief understanding. That said, research does tend to find a relation between FB understanding and a variety of trust questions (DiYanni et al., 2012; Lucas, Lewis, Pala, Wong, & Berridge, 2013; Miller, 2016; c.f. Pasquini, Corriveau, Koenig, & Harris, 2007).

The current study used the ToM scale developed by Wellman and Liu (2004) to move beyond false-belief tasks; however, there were no relationships between the ToM scale and trust. When two relevant sub-tasks (False Belief and Knowledge-Ignorance) were used in place of total ToM, there were two interconnected correlations for KI, but none for FB, after controlling for age (see Table 5). These relationships suggest that children's tracking of the informant's accuracy is based on what the informant *knows* rather than the outcome of their behavior. However, understanding that others can be knowledgeable versus ignorant did not continue to have

relevance for the most important of the trust questions: asking children to choose who to learn from (i.e., the endorse question). For the endorse question, there was a marginal correlation with FB but not after controlling for age. Accordingly, the totality of the current findings and the extant literature suggest that FB is only sometimes relevant for deciding who to learn from. This suggests that children can learn from reliable informants for different reasons (i.e., through different processes).

Presumably all forms of social learning are related to social-cognitive developments. However, the empirical links between trust research and ToM is greater than those between ToM and (over)-imitation. Part of the reason may be that there are other more relevant forms of social-cognition related to imitation that do not involve "mental-state attribution" (i.e., what ToM measures). This may be especially true for children before age 4 when mental-state attribution is unnecessary for participation in social realities (Allen & Bickhard, 2018; Perner, 2010). This suggests the possibility that ToM measures may be most relevant when social learning is dominated by linguistic forms of learning from others (i.e., trust research). In fact, the dominance of language for learning from others around age 4 coincides with the sharp decline in spontaneous imitation at around age 4 (Nadel, 2006). Overall, the results make clear the need for more studies on the relations between social-learning and social-cognition in the preschool years.

4.3. Scope of the trust manipulation

Research on trust has consistently found that preschool aged children are sensitive to a variety of cues for establishing an informants' epistemic reliability starting at around age three (Harris, Corriveau, Pasquini, Koenig, & Clément, 2012; Mills, 2013). Results from the current study are consistent with this age norm for the most commonly used cue – accuracy. However, contrary to expectations, children showed a systematic bias for the toy chosen by the reliable informant. The toy-preference task was intended as a task-irrelevant choice that should not depend on which model had been reliable for the functioning of objects. Counterintuitively, it was the older children who showed this bias while the younger children were at chance levels. If the younger children were showing the bias, this would be consistent with the idea that before age 4, children do tend to over-extend reliability beyond the domain of relevance (Corriveau & Harris, 2009; Corriveau et al., 2013; Harris & Corriveau, 2011). However, given that the bias was for the older children, there may be cultural differences in how broadly the reliability manipulation affects children's preferences. Lucas et al. (2013) found that Turkish children were the only ones from a group that included English and Chinese children to show "flexible trust" (i.e., to choose the correct expert for two different domains). That is, in contrast to the Turkish children, the Chinese children selected the same informant for both domains. This means the Turkish sample in the current study is responding more similarly to the Chinese children from Lucas et al. than to their Turkish sample. While there are obvious design differences between the current study and that of Lucas et al. (e.g., there was not an explicit contrast between the two informants across the two domains), we believe more studies are needed within and across cultures to better understand the nature and scope of reliability manipulations for preschool-aged children.

Trust findings highlight that although children as young as three are open to the effects of an accuracy manipulation, the nature of how reliability is understood by children may be different with age. This raises the possibility that the same may be true for over-imitation. That is, children in the same over-imitation paradigm may be doing over-imitation for different reasons. Especially in terms of the amount of social-interaction content that is being learned. Although children show clear examples of over-imitation at age 2 (Nielsen, 2006, they may be doing it to learn more about the normative (or causal) structure of the artifact itself, while older children may be doing it to learn more about normative structure of social situation as a whole (Allen & Ilgaz, 2017). An implication of this possibility is that, if preschool aged children encounter a relatively complex object, they may end up more focused on learning about the structure of the artifact than the broader social situation. Regardless of the focus of the learning, all of the over-imitation activity would still have social-motivational aspects.

5. Conclusion

This paper has argued for a social situation approach to social-learning. This approach motivated the exploration of model reliability for over-imitation behavior. The results were equally well motivated for a norm-artifact approach and to a lesser extent, for a social-engagement approach. The results were least consistent with the physical-object perspective and contribute to a growing consensus for the sociocultural nature of over-imitation phenomena (Legare et al., 2015; Nielsen, 2018).

A limitation of extant trust paradigms is that they typically use a within-subjects design when trying to measure children's selective preference for the reliable source of information. This makes the contrast between the two informants particularly salient and is likely to facilitate performance on the various dependent measures. Issues about the ecological validity of a within-subjects design has been noted by others and it has been suggested here that using a between-subjects design was an important contribution to the literature on selective social learning more broadly.

Declaration of Competing Interest

The authors report no declarations of interest

References

Alessandroni, N., & Rodriguez, C. (2017). Is *container* a natural and embodied image schema? A developmental, pragmatic, and cultural proposal. *Human Development, 60*, 144–178. https://doi.org/10.1159/000478841

Andrews, K. (2012). *Do apes read minds?* Cambridge, MA: MIT Press.

Allen, J. W. P. (2012). Imitation situations: Learning to use others as a resource for further activity. PhD Dissertation, Department of Psychology. *Lehigh University*.
Allen, J. W. P., & Ilgaz, H. (2016). Aynanın İçerisinden: Çocukların Taklit Yoluyla Öğrenerek Kültür Edinme Yolculukları. In D. Tahiroglu, A. Kuntay, T. Göksun, & C. Aydin (Eds.), *Aklın Çocuk Hali: Zihin Gelişimi Araştırmaları içinde* (pp. 131–155). Istanbul: Koç Universitesi Yayınları.
Allen, J. W. P., & Ilgaz, H. (2017). Social meta-learning: Learning how to make use of others as a resource for further learning. In R. Hakli (Ed.), *Studies in the Philosophy of Sociality* (pp. 89–113). New York: Springer.
Allen, J. W. P., & Bickhard, M. H. (2018). Stage fright: Internal reflection as a domain-general enabling constraint on the emergence of explicit thought. *Cognitive Development, 45*, 77–91. https://doi.org/10.1016/j.cogdev.2017.12.005.
Burdett, E. R., McGuigan, N., Harrison, R., & Whiten, A. (2018). The interaction of social and perceivable causal factors in shaping "Over-imitation". *Cognitive Development, 47*, 8–18. https://doi.org/10.1016/j.cogdev.2018.02.001
Carpendale, J. I. M., & Lewis, C. (2015). The development of children's understanding of social interaction. In S. Robson, & S. F. Quinn (Eds.), *The Routledge international handbook of young children's thinking and understanding* (pp. 123–132). New York: Routledge.
Clay, Z., Over, H., & Tennie, C. (2018). What drives young children to over-imitate? Investigating the effects of age, context, action type, and transitivity. *Journal of Experimental Child Psychology, 166*, 520–534. https://doi.org/10.1016/j.jecp.2017.09.008
Christopher, J. C., & Bickhard, M. H. (2007). Culture, self and identity: Interactivist contributions to a metatheory for cultural psychology. *Culture & Psychology, 13*, 259–295. https://doi.org/10.1177/1354067X07079881.
Bickhard, M. H. (2008). Social ontology as convention. *Topoi, 27*, 139–149. https://doi.org/10.1007/s11245-008-9036-1.
Corriveau, K., & Harris, P. L. (2009). Choosing your informant: Weighing familiarity and recent accuracy. *Developmental Science, 12*, 426–437. https://doi.org/10.1111/j.1467-7687.2008.00792.x
Corriveau, K. H., DiYanni, C. J., Clegg, J. M., Min, G., Chin, J., & Nasrini, J. (2017). Cultural differences in the imitation and transmission of inefficient actions. *Journal of Experimental Child Psychology, 161*, 1–18. https://doi.org/10.1016/j.jecp.2017.03.002
Corriveau, K. H., Kinzler, K. D., & Harris, P. L. (2013). Accuracy trumps accent in children's endorsement of object labels. *Developmental Psychology, 49*, 470–479. https://doi.org/10.1037/a0030604
DiYanni, C., Nini, D., Rheel, W., & Livelli, A. (2012). 'I won't trust you if I think you're trying to deceive me': Relations between selective trust, theory of mind, and imitation in early childhood. *Journal of Cognition and Development, 13*, 354–371. https://doi.org/10.1080/15248372.2011.590462
Einav, S., & Robinson, E. J. (2011). When being right is not enough: Four-year-olds distinguish knowledgeable informants from merely accurate informants. *Psychological Science, 22*, 1250–1253. https://doi.org/10.1177/0956797611416998
Gergely, G. (2003). The development of teleological versus mentalizing observational learning strategies in infancy. *Bulletin of the Menninger Clinic, 67*, 113–131.
Gergely, G., Bekkering, H., & Kiraly, I. (2002). Rational imitation in preverbal infants: Babies may opt for a simpler way to turn on a light after watching an adult do it. *Nature, 415*, 755. https://doi.org/10.1038/415755a
Harris, P. L., & Corriveau, K. H. (2011). Young children's selective trust in informants. *Philosophical Transactions of the Royal Society, 366*, 1179–1187. https://doi.org/10.1098/rstb.2010.0321
Harris, P. L., Corriveau, K. H., Pasquini, E. S., Koenig, M. A., & Clément, F. (2012). Credulity and the development of selective trust in early childhood. In M. Beran, J. Brandl, J. Perner, & J. Proust (Eds.), *Foundations of metacognition* (pp. 193–210). NY: Oxford Press.
Heyes, C. (2012). Grist and mills: On the cultural origins of cultural learning. *Philosophical Transactions Biological Sciences, 367*, 2181–2191. https://doi.org/10.1098/rstb.2012.0120
Hoehl, S., Keupp, S., Schleihauf, H., McGuigan, N., Buttelmann, D., & Whiten, A. (2019). "Over-imitation": A review and appraisal of a decade of research. *Developmental Review, 51*, 90–108.
Horner, V., & Whiten, A. (2005). Causal knowledge and imitation/emulation switching in chimpanzees (Pan troglodytes) and children (Homo sapiens). *Animal Cognition, 8*, 164–181. https://doi.org/10.1007/s10071-004-0239-6
Huang, C. T., Heyes, C., & Charman, T. (2006). Preschoolers' behavioral reenactment of "failed attempts": The roles of intention-reading, emulation and mimicry. *Cognitive Development, 21*, 36–45. https://doi.org/10.1016/j.cogdev.2005.09.002
Jones, S. S. (2007). Imitation in infancy: The development of mimicry. *Psychological Science, 18*, 593–599. https://doi.org/10.1111/j.1467-9280.2007.01945.x
Kenward, B. (2012). Over-imitating preschoolers believe unnecessary actions are normative and enforce their performance by a third party. *Journal of Experimental Child Psychology, 112*, 195–207. https://doi.org/10.1016/j.jecp.2012.02.006
Kenward, B., Karlsson, M., & Persson, J. (2011). Over-imitation is better explained by norm learning than by distorted causal learning. *Proceedings of the Royal Society B, 278*, 1239–1246. https://doi.org/10.1098/rspb.2010.1399
Király, I., Csibra, G., & Gergely, G. (2013). Beyond rational imitation: Learning arbitrary means actions from communicative demonstrations. *Journal of Experimental Child Psychology, 116*, 471–486. https://doi.org/10.1016/j.jecp.2012.12.003
Koenig, M. A., & Harris, P. (2005). The role of social cognition in early trust. *TICS, 9*, 457–459. https://doi.org/10.1016/j.tics.2005.08.006
Koenig, M. A., & Harris, P. L. (2007). The basis of epistemic trust: Reliable testimony or reliable sources? *Episteme, 4*, 264–284. https://doi.org/10.3366/E1742360007000081
Koenig, M. A., & Sabbagh, M. A. (2013). Selective social learning: New perspectives on learning from others. *Developmental Psychology, 49*, 399–403. https://doi.org/10.1037/a0031619
Legare, C. H., Wen, N. J., Herrmann, P. A., & Whitehouse, H. (2015). Imitative flexibility and the development of cultural learning. *Cognition, 142*, 351–361. https://doi.org/10.1016/j.cognition.2015.05.020
Lucas, A. J., Lewis, C., Pala, F. C., Wong, K., & Berridge, D. (2013). Social-cognitive processes in preschoolers' selective trust: Three cultures compared. *Developmental Psychology, 49*, 579–590. https://doi.org/10.1037/a0029864
Lyons, D. E. (2009). The rational continuum of human imitation. In J. A. Pineda (Ed.), *Mirror neuron systems: The role of mirroring processes in social cognition* (pp. 77–103). New York: Humana Press.
Lyons, D. E., Young, A. G., & Keil, F. C. (2007). The hidden structure of over-imitation. *PNAS, 104*, 19751–19756. https://doi.org/10.1073/pnas.0704452104
McGuigan, N., Whiten, A., Flynn, E., & Horner, V. (2007). Imitation of causally opaque versus causally transparent tool use by 3- and 5-year-old children. *Cognitive Development, 22*, 353–364. https://doi.org/10.1016/j.cogdev.2007.01.001
Meltzoff, A. N. (1995). Understanding the intentions of others: Re-enactment of intended acts by 18 -month-old children. *Developmental Psychology, 31*, 838–850. https://doi.org/10.1037/0012-1649.31.5.838
Miller, S. A. (2016). *Parenting and theory of mind*. Oxford University Press.
Mills, C. M. (2013). Knowing when to doubt: Developing a critical stance when learning from others. *Developmental Psychology, 49*, 404–418. https://doi.org/10.1037/a0029500
Nadel, J. (2006). Does imitation matter to children with autism? In S. J. Rogers, & J. H. G. Willams (Eds.), *Imitation and the social mind: Autism and typical development* (pp. 118–137). New York, NY, US: Guilford Press.
Nielsen, M. (2006). Copying actions and copying outcomes: Social learning through the second year. *Developmental Psychology, 42*, 555–565. https://doi.org/10.1037/0012-1649.42.3.555
Nielsen, M. (2018). The social glue of cumulative culture and ritual behavior. *Child Development Perspectives, 12*, 264–268. https://doi.org/10.1111/cdep.12297
Nielsen, M., & Blank, C. (2011). Imitation in young children: When who gets copied is more important that what gets copied. *Developmental Psychology, 47*, 1050–1053. https://doi.org/10.1037/a0023866
Nielsen, M., Tomaselli, K., & Kapitány, R. (2018). The influence of goal demotion on children's reproduction of ritual behavior. *Evolution and Human Behavior, 39*, 343–348. https://doi.org/10.1016/j.evolhumbehav.2018.02.006
Nurmsoo, E., & Robinson, E. J. (2009). Children's trust in previously inaccurate informants who were well or poorly informed: When past errors can be excused. *Child Development, 80*, 23–27.

Over, H., & Carpenter, M. (2012). Putting the social into social learning: Explaining both selectivity and fidelity in children's copying behavior. *Journal of Comparative Psychology, 126*, 182–192. https://doi.org/10.1037/a0024555

Özoran, D. (2009). *Cognitive development of Turkish children on the relation of evidentiality and theory of mind*. Unpublished master's thesis. Ankara, Turkey: Middle East Technical University.

Pasquini, E. S., Corriveau, K. H., Koenig, M., & Harris, P. (2007). Preschoolers monitor the relative accuracy of informants. *Developmental Psychology, 43*, 1216–1226. https://doi.org/10.1037/0012-1649.43.5.1216

Paulus, M., Hunnius, S., Vissers, M., & Bekkering, H. (2011). Imitation in infancy: Rational or motor resonance? *Child Development, 82*, 1047–1057. https://doi.org/10.1111/j.1467-8624.2011.01610.x

Perner, J. (2010). Who took the cog out of cognitive science. In P. A. Frensch, & R. Schwarzer (Eds.), *Cognition and neurospsychology: International perspectives on psychological science* (Vol. 1). Hove, UK: Psychology Press. pp. 241e262.

Rakoczy, H., Warneken, F., & Tomasello, M. (2008). The sources of normativity: Young children's awareness of the normative structure of games. *Developmental Psychology, 44*, 875–881. https://doi.org/10.1037/0012-1649.44.3.875

Robinson, E. J., Nurmsoo, E., & Einav, S. (2014). Does understanding about knowledge and belief influence children's trust in testimony? In E. J. Robinson, & S. Einav (Eds.), *Trust and skepticism: Children's selective learning from testimony* (pp. 42–54). New York, NY: Psychology Press.

Rodriguez, C. (2007). Object, communication and signs. The triadic basis of early cognitive development. In J. Valsiner, & A. Rosa Rivero (Eds.), *The Cambridge handbook of socio-cultural psychology* (pp. 257–276). New York, NY: Cambridge University Press. https://doi.org/10.1017/CBO9780511611162.015.

Tomasello, M., Kruger, A. C., & Ratner, H. H. (1993). Cultural learning. *Behavioral and Brain Sciences, 16*, 495–552. https://doi.org/10.1017/S0140525X0003123X

Uzgiris, I. C. (1981). Two functions of imitation during infancy. *International Journal of Behavioral Development, 4*, 1–12. https://doi.org/10.1177/016502548100400101

Wellman, H. M., & Liu, D. (2004). Scaling of theory-of-mind tasks. *Child Development, 75*, 523–541. https://doi.org/10.1111/j.1467-8624.2004.00691.x

Whiten, A., McGuigan, N., Marshall-Pescini, S., & Hopper, L. M. (2009). Emulation, imitation, over-imitation and the scope of culture for child and chimpanzee. *Philosophical Transactions of the Royal Society B: Biological Sciences, 364*, 2417–2428. https://doi.org/10.1098/rstb.2009.0069

Wilks, M., Kapitány, R., & Nielsen, M. (2016). Preschool children's learning proclivities: When the ritual stance trumps the instrumental stance. *British Journal of Developmental Psychology, 34*, 402–414. https://doi.org/10.1111/bjdp.12139

Zmyj, N., Buttelmann, D., Carpenter, M., & Daum, M. M. (2010). The reliability of a model influences 14-month-olds' imitation. *Journal of Experimental Child Psychology, 106*, 208–220. https://doi.org/10.1016/j.jecp.2010.03.002