Cognitive Development 24 (2009) 61–69

Contents lists available at ScienceDirect

Cognitive Development

Short report

Young children's selective learning of rule games from reliable and unreliable models

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ARTICLE INFO

Keywords:
Theory of mind
Cultural learning
Normativity

ABSTRACT

We investigated preschoolers' selective learning from models that had previously appeared to be reliable or unreliable. Replicating previous research, children from 4 years selectively learned novel words from reliable over unreliable speakers. Extending previous research, children also selectively learned other kinds of acts – novel games – from reliable actors. More important, – and novel to this study, this selective learning was not just based on a preference for one model or one kind of act, but had a normative dimension to it. Children understood the way a reliable actor demonstrated an act not only as the better one, but as the normatively appropriate or correct one, as indicated in both their explicit verbal comments and their spontaneous normative interventions (e.g., protest, critique) in response to third-party acts deviating from the one demonstrated. These findings are discussed in the broader context of the development of children's social cognition and cultural learning.

Much of what we know and do we have learned from others. This process of cultural learning has its roots in earliest infancy, when imitation begins. From the second year, infants begin to imitatively learn instrumental, playful, symbolic and other kinds of acts from adults (Carpenter, Nagell, & Tomasello, 1998; Casler & Kelemen, 2005; Gergely, Bekkering, & Király, 2002; Meltzoff, 1995). When imitating others, even young children seem not to be confined to re-enact merely idiosyncratic intentional acts of an individual. Rather, they learn something about general forms of actions, with such forms being structured by normative dimensions of appropriate and inappropriate performance. An indirect indicator of such an understanding can be seen, for example, in the phenomenon of functional fixedness:

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0885-2014/$ – see front matter © 2008 Elsevier Inc. All rights reserved.
doi:10.1016/j.cogdev.2008.07.004

When children from 2 years see someone use a novel object systematically in an instrumental way, they not only use the object in similar ways themselves later on, but *only* use it for this purpose and assume other people will do so as well (Casler & Kelemen, 2005). On a rich interpretation, this could be taken to show that children not only understand what the other person was up to, but also understand how one appropriately acts with the tool because that is what it is for.

While such a rich reading of the functional fixedness data is not necessarily warranted (children could fixate on a way of treating the object they merely see as *usual*, but not necessarily as *normatively licensed*), recent work has documented children's learning of novel acts with normative structure in more direct ways. In a set of studies (Rakoczy, 2008; Rakoczy, Warneken, & Tomasello, 2008), young children (age 2 and 3) first saw an experimenter demonstrate a novel simple rule game (called, e.g., "daxing"). In the course of this demonstration, the experimenter performed two kinds of acts, one of which was marked as the proper game ("This is daxing"), while the other one was marked as an accident ("Whoops!"). Subsequently, children not only learned to play the game imitatively themselves; they also indicated that they understood the demonstrated way to play the game as the normatively correct one by criticizing third parties that announced their participation in "daxing" and then performed inappropriate acts.

This normative understanding, furthermore, involves some basic sensitivity to the context of the actions: In one control condition, when the model performed the same kinds of behaviours but these were all neutrally marked (as unspecific acts), children did not jump to any normative conclusions and did not criticize third parties. In another control condition, the demonstration and the act of the third party were exactly alike, but the announcement of the third party was different: She announced that she did not want to participate in the game (and thus her subsequent act did not constitute a mistake). Obviously taking this announcement into account, children now did not criticize her.

Young preschoolers thus are not only social learners; they are also normative learners in rudimentary form. But how sophisticated and specific are young children's abilities to engage in cultural normative learning? In particular, apart from some rudimentary context-specificity (mentioned above), how systematic and selective is young children's learning of normatively structured activities from others?

Selectivity in learning from different kinds of models has been the focus of much recent research in social cognitive development (for overviews, see Koenig & Harris, 2005a). Numerous studies have revealed that children from around 3 to 4 take into account different properties of models when having to select between two models in novel word learning situations. First, children are sensitive to expressions of knowledge versus ignorance, preferring knowledgeable models over ignorant ones (Koenig & Harris, 2005b; Studies 2 and 3; Sabbagh & Baldwin, 2001, Study 1). Second, children take into account expressed (un-) certainty and confidence, selectively trusting confident and certain models (Birch, Frampton, & Akmal, 2006; Matsui, Yamamoto, & McCagg, 2006; Moore, Bryant, & Furrow, 1989; Sabbagh & Baldwin, 2001; Study 2). Third, children prefer adult over peer models when learning novel words (Jaswal & Neely, 2006). Fourth, children have been found to differentiate between models of varying degrees of familiarity, preferring more familiar ones (e.g., caregivers at their own day-care center) over less familiar ones (caregivers from other day-care centers; Corriveau, Pasquini, & Harris, 2006). Finally, the best-documented achievement of preschoolers is their ability to track and take into account the varying reliability of different agents. When children first witness two agents one of whom proves reliable in naming familiar objects while the other proves unreliable, and then can choose between the two agents in learning novel words for novel objects, 4-year-olds (and sometimes 3-year-olds) prefer the previously reliable agent (Clément, Koenig, & Harris, 2004; Jaswal & Neely, 2006; Koenig & Harris, 2005b; Koenig, Clément, & Harris, 2004; Pasquini, Corriveau, Koenig, & Harris, 2007).

What becomes clear from this line of research is that young preschoolers differentiate between models and tend to prefer reliable, adult, confident and knowledgeable models over unreliable, peer, unconfident and ignorant models when learning novel words. But it is not totally clear what this preference indicates: Do children think that one model is more competent and knows the correct answer to culturally relevant questions? Or is their preference – though prompted by the models' indications of competence and knowledge – simpler, such that they merely like one model more and thus prefer to follow her? In other words: Do the indications of competence make the model simply

more attractive to the child? While the latter possibility does not seem highly plausible on the face of it, arguably it cannot be ruled out, in particular in light of the findings with regard to model familiarity: Given that children show a similar pattern of preference for familiar over unfamiliar models, this might put into question the claim that the preference for the reliable over unreliable models is in fact based on estimations of competence (versus differential sympathy).

In sum, then, preschool children have been shown to be cultural normative learners: Not only do they learn through imitation, but they learn from adult models normatively structured forms of action – how one performs them correctly. (This becomes clearest in children's protest against third party mistakes.) But we do not know how systematic and specific such normative learning is. Yet preschoolers have been shown to be systematic and selective in their learning of words from others, preferring for example reliable over unreliable models. Several questions, however, remain unanswered. First, we do not yet know exactly what this selectivity is based on. Second, we do not know how general this selectivity is – virtually all existing studies so far have looked at linguistic learning only (of sortals or labels of object function; the sole exceptions are studies by Koenig and Harris (2005b; Study 3) and by Birch, Vauthier, and Bloom (in press) that looked at object functions and allowed children to answer verbally or by re-enacting a demonstrated function. Third, and in particular, we do not know yet whether children view the way of doing something they selectively imitate from reliable models in normative terms – as the *appropriate* way to do it.

The present work, therefore, aims at addressing these questions by bringing together the two lines of inquiry on children's selective learning and on their normative learning. Toward this aim, children's selective acquisition of normatively structured activities (beyond only linguistic learning) from differentially reliable models was studied.

Pilot work suggested that selective learning extends beyond the domain of word learning and could be found on a comparable scale in the domain of playing games. When confronted with two characters (one of them previously reliable, the other previously unreliable) who played a game in different ways, children at 4 years of age selectively played the game in the way the previously reliable model did. In this pilot work, however, in a second phase, when a third party played the game either like the reliable or like the unreliable model, children rarely intervened spontaneously and thus left open the question of their normative understanding.

The present study, therefore, more thoroughly investigated the nature of such selective learning in children of this age, in particular regarding the question of whether children understand the action they selectively imitate in normative terms (as the correct/appropriate one). Toward this end, children were shown two hand puppets who first proved reliable or unreliable and then demonstrated different ways of playing a game. In addition to children's selective imitation, two measures of normative understanding were used: explicit questions (Who played the game correctly?) and spontaneous interventions (such as protest, critique or teaching in response to either of the puppets' ways of playing).

1. Method

1.1. Participants

Twenty-three young 4-year-olds (47–51 months, mean = 49 months; 11 boys) and 16 older 5-year-olds (67–72 months, mean = 70 months; 7 boys) were included in the final sample. Two additional children were tested but had to be excluded because they turned out to be bilingual ($n = 1$) or uncooperative ($n = 1$).

1.2. Material

Two hand puppets, a cow and an elephant, were used as reliable and unreliable models. Both were operated, with different voices, by E2. Several novel objects and novel games were used for test trials.

1.3. Design and procedure

At the beginning of each session, E1 played with the child and the two puppets (e.g., by rolling balls back and forth between them) until the child felt comfortable. Then each child participated in three

Table 1
Temporal structure of the Novel game trials

1	First the two puppets were absent and E1 brought out the game materials and introduced the general structure of the game: "Look, this is a game called 'Baffing'. First, one had to toss this disc, and only one side wins. Then one can make music." *Question Q1*: "Hm, but which side wins? Who do you think knows this (pointing in the direction where the puppets had been)?"
2	Regardless of the child's answer, puppet 1 (each puppet in half of the trials) then appeared and explained her version of the rules. For example "The apple wins; the banana does not win". *Question Q2*: "Did the puppet say this correctly or incorrectly?"
3	Puppet 2 came and played the game twice (surreptitiously throwing the disc, for example, such that each side came up once). In each round, the puppet performed step 1, and then commented on what followed according to her rule. In the positive case she commented, e.g., "Ah, the apple! Now I can make music" and then went on slowly to make music (leave the child approximately 5 sec. to intervene). In the negative case the puppet said "Oh, the banana. Now I cannot make music", and looked sadly for approximately 5 sec. (again, to give the child the chance to intervene).
4	E1 then told the child that it was his or her turn to play the game, and the child was allowed to play twice ("turn 1").
5	Puppet 1 played twice (once each side of the disc).
6	Puppet 2 played twice (once each side of the disc).
7	The child was allowed to play twice ("turn 2"). *Question Q3*: "Now, how do you play baffing?" (if the child did not spontaneously answer, E1 asked first about step 1, e.g., "What do you do with this (disc)?", and then about step 2, e.g., "and then when can you make music?"). *Question Q4*: "And who has baffed correctly?"

kinds of tasks: *Familiarization trials* in which one of the puppets performed correct verbal and non-verbal actions while the other puppet performed incorrect ones, *Novel Label* tasks, and *Novel Game* tasks in which the child saw two models demonstrate different ways of playing a novel game. The session was structured as follows.

(1) Familiarization trials

A total of eight familiarization trials were presented in which one of the puppets acted correctly and the other one incorrectly, four of them involving labeling, four non-verbal actions (for example, both puppets tried to draw, the reliable one successfully with a functioning pen, the unreliable one unsuccessfully with a visibly malfunctioning one). After each trial, children were asked whether someone had said or done something wrong. Four such trials (two involving labeling, two with non-verbal actions) were administered, two blocks of two trials each (one involving labeling, one with non-verbal actions) before the novel game trials and the novel label trials.

(2) Novel game trials

To accustom the child to playing games, E1 and the child first played a simple rule game without the puppets (after which came two familiarization trials before the four target novel game trials started).

The games were very similar to those used in a recent study (Rakoczy et al., 2008; Study 2a): there were always two steps involved, where the result of step 1 determined what could be done in step 2. For example, in a game called "Baffing" in step 1 a disc was tossed which had different symbols on either side (an apple and a banana), and depending on which side was up, one could then make music in step 2 or not. The two puppets always played according to opposite rules. For example, the cow played according to the rule "Only if the banana is up, one can make music", while the elephant played according to "Only if the apple is up, one can make music". The temporal structure of the novel game trials in summarized in Table 1.

(3) Novel label trials

The structure of these novel label trials was slightly different from the procedure used by Koenig et al. (2004) and others and more structurally analogous to the novel game trials. First, E1

introduced a novel object and asked the child whether she knew what this was (allowing the child to explore the object and correcting her if necessary). She then asked the "Know" question Q1: "Who do you think knows what this is?". Then one of the puppets appeared (each one on half of the trials), puppet 1, and labeled the object (e.g., as "Doso"). E1 then asked the child the second question Q2: "Hm, do you think this is a doso?". Then puppet 2 came and gave the object a different label (e.g. "Blicket"). Finally, E1 asked the child the last (endorsement) question Q3: "And now, what is this?".

Across children, it was counterbalanced which of the puppets was the reliable one, which one sat at which side of the table and which one came first in which of the label and game trials.

1.4. Observational and coding procedure

All sessions were videotaped and coded from tape by a single observer. A second independent observer coded a random sample of 20% of all the sessions for reliability.

1.4.1. Questions

For all questions in the familiarization trials, novel game and novel label trials in which children only had to pick one of the models, children's answers were scored as "correct" if the child picked one puppet correctly, "incorrect" if the child picked the wrong puppet. These two codes were not exhaustive as children could (and a few did) claim, for example, that no one said something wrong which was coded as "other." For Q3 (how is the game played?) in the novel game trials, children's answers were scored "correct" if they explained the game according to the reliable puppet's rules, and "incorrect" if they explained it the way the unreliable puppet had.

1.4.2. Novel game trials: Imitation

For each game trial the child's action was coded as "correct" if he or she followed the reliable puppet, "incorrect" if he or she played like the unreliable puppet (and "other" if the child did neither or played in mixed ways). Reliability of coding was .92.

1.4.3. Novel game trials: protest

All relevant intervention responses and utterances made by the child were carefully noted and assigned one of two codes. (1) *Normative protest*. The child clearly intervened in a normative way, making use of normative vocabulary (e.g., "No! It does not go like this!"). (2) *Imperative protest.* The child intervened in response to the puppet's act, expressing critique. The child did this, however, without explicitly normative vocabulary, but rather with imperatives, either in the negative (e.g., "No! Not in this hole!") or in the positive (e.g., "Take the stick!"). Reliability of coding was .98.

For each game it was then determined whether and against which puppet the child leveled protest of any kind in one of the turns of the game. Each game received an overall code "protest in response to reliable puppet" if the child only protested against the reliable puppet, and analogously for the unreliable puppet. If the child protested against both puppets in the process of one game, this game received the code "inconsistent protest".

2. Results

2.1. Familiarization trials

Children performed virtually at ceiling (with the exception of one 4-year-old child failing 2 questions after a labeling trial).

2.2. Novel label trials

The mean sums of "correct" and "incorrect" answers over the different types of questions in the four novel label trials are depicted in Table 2. For statistical purposes, for each type of task and for each subject difference scores were computed ("correct" minus "incorrect" responses, not taking into

Table 2
Mean number of correct answers to the three types of questions in the Novel label tasks

	Q1 (who ask?)	Q2 (was this correct?)	Q3 (endorse label)
4-year-olds	2.6	3	2.7
5-year-olds	3.3	3	3.1

Note. For 4-year-olds, for Q1, $t(22) = 2.01$, $p < .05$, for Q2, $t(22) = 5.03$, $p < .01$, and for Q3, $t(22) = 3.01$, $p < .01$. For 5-year-olds, for Q1, $t(15) = 4.87$, $p < .01$, for Q2, $t(15) = 5.20$, $p < .01$, and for Q3, $t(15) = 4.13$, $p < .01$.

account "other" responses). These difference scores were significantly greater than zero for both age groups (i.e., both age groups gave significantly more correct than incorrect answers; see Table 2) for all three-question types, with no significant differences between the age groups (*t*-tests, *ps* > .10, two-tailed).

2.3. Novel game trials: questions

The mean sums of "correct" and "incorrect" answers over the different types of questions in the four novel game trials are depicted in Fig. 1. For statistical purposes, difference scores (analogous to the Novel label tasks) between "correct" and "incorrect" responses were computed (not taking into account "other" responses) and tested against chance (zero). The 5-year-olds gave significantly more correct than incorrect answers to all question types – Q1: $t(15) = 8.60$; Q2: $t(15) = 3.42$; Q3: $t(15) = 4.68$; Q4: $t(15) = 6.28$; all *ps* < .01. The 4-year-olds did so significantly for questions Q3, $t(22) = 2.17$, $p < .05$, and Q4, $t(22) = 2.22$, $p < .05$, and showed a trend in the same direction for Q1, $t(22) = 1.38$, $p < .09$, and Q2,$t(22) = 1.60$, $p < .07$. The age groups differed significantly only on Q1, $t(37) = 2.30$, $p < .05$, two-tailed.

2.4. Novel game trials: Imitation

Children had two turns (turn 1 and turn 2) of playing the game themselves, each turn consisting of two acts. Per turn children's responses were only scored as "correct" if they played correctly (i.e., imitated the reliable model) twice (and as "incorrect" in analogous ways only if they imitated the

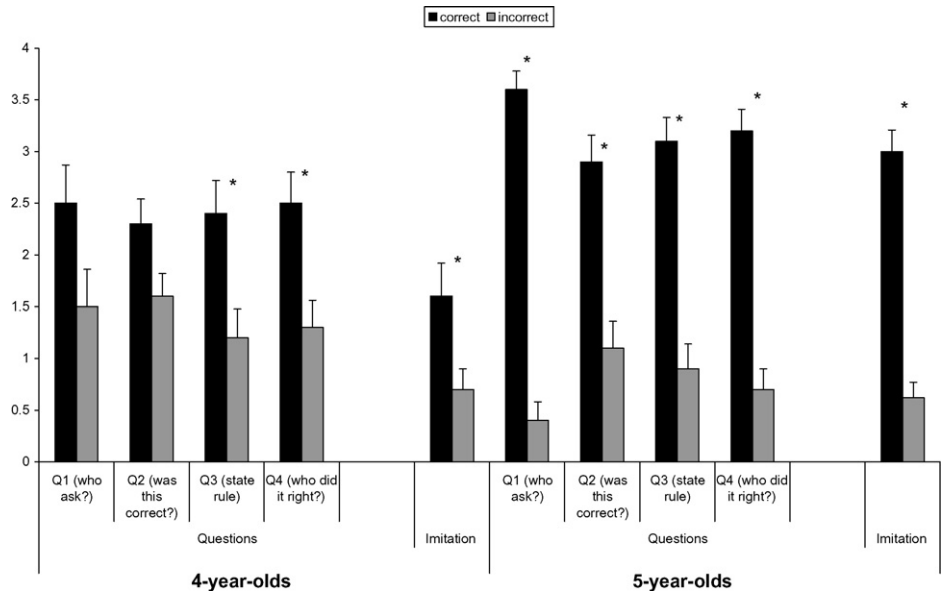

Fig. 1. Mean correct/incorrect answers and mean correct/incorrect number of imitations (in both trials) in the Novel game tasks.

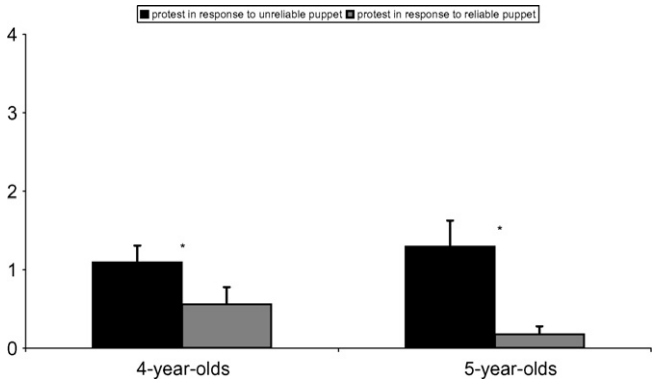

Fig. 2. Mean sum of protest in response to the two puppets.

unreliable model twice). The mean numbers of children's correct and incorrect imitations in both turns taken together are depicted in Fig. 1. For statistical purposes, difference scores between "correct" and "incorrect" responses were computed (not taking into account "other" responses) and tested against chance (zero). Taking both turns together, both age groups imitated correctly significantly more often than incorrectly. For 4-year-olds: $t(22) = 2.10$, $p < .03$. For 5-year-olds: $t(15) = 6.84$, $p < .001$. When taking turn 1 and turn 2 separately, the effects were highly significant for 5-year-olds. For turn 1, $t(15) = 6.48$, $p < .001$; for turn 2, $t(15) = 7.10$, $p < .001$). For 4-year-olds the effect was significant for turn 2, $t(22) = 2.73$, $p < .01$,and approached significance for turn 1, $t(22) = 1.64$, $p < .063$. In each turn separately, and in both turns taken together, effects were stronger among 5-year-olds than 4-year-olds (t-tests, $ps < .058$, two-tailed).

2.5. Novel game trials: protest

The mean numbers of games with consistent protest against either puppet are depicted in Fig. 2 ("Inconsistent protest" occurred only once in one 4-year-old child.) Both age groups performed more protest in response to the unreliable than the reliable puppet. For4-year-olds, $t(22) = 1.82$, $p < .01$. For 5-year-olds, $t(15) = 3.92$, $p < .001$), with no significant difference between age groups. On an individual level, of 23 4-year-olds, 16 (70%) intervened in response to the unreliable puppet at least once, and 6 (26%) did so in response to the reliable puppet (McNemar test, $p < .01$). Of 16 5-year-olds, 10 (63%) intervened in response to the unreliable puppet at least once, while 3 (19%) did so in response to the reliable puppet (McNemar test, $p < .05$).

3. Discussion

Drawing on lines of research on trust in 3–5-year-olds and on normative learning in 2- and 3-year-olds, the present work focused on young children's selectivity toward different models, with the following guiding questions: How general is young children's selective learning (beyond the domain of world learning)? And how normatively structured is early selective learning – do young children understand what they selectively imitate in normative terms as the correct or appropriate thing to do?

With regard to the former question, the results clearly document that selective learning extends to non-linguistic rule-governed activities such as simple games. Children from age 4 selectively learned novel words and novel games from a reliable actor in much the same way.

With regard to the latter question, the present study supplies converging evidence from different measures that young children not only prefer the action demonstrated by a reliable actor but also consider it in normative terms as the correct or appropriate action. Children not only imitated the reliable actor when playing the game themselves, but explicitly claimed the reliable puppet had played correctly while the unreliable one played incorrectly (questions Q2 and Q4), and they could even

state the rules of the game according to the way the reliable puppet had played it (question Q3). And finally children enforced the way of playing introduced by the reliable actor toward third parties: They spontaneously showed normative interventions such as protest and critique ("No! That's not the way one plays it!") in response to the unreliable puppet's way of playing the game (and protested in response to the reliable puppet significantly less). The study reported here thus presents data from three diverse kinds of measures (selective imitation, explicit judgment and spontaneous normative intervention) that all converge, and thus taken together suggest that young children are capable of engaging in selective *normative* learning. One question that remains and needs to be addressed in future research, however, is to what degree these measures are inter-related. One possibility, for example, is that systematic questioning when prompting verbal judgments (as to whether someone had done something wrong) primed children to pay attention to normative aspects of the situation (and thus lead to more spontaneous protest, or rather, semi-spontaneous protest).

While the present work thus documents some general competence (showing *that* children from at latest 4 years of age can learn novel actions understood in normative terms in selective ways), it remains to be investigated how this competence gets expressed in actual performance: *When*, *under which circumstances* and *how* do young children engage in selective normative learning? Which cues, for example, do they make use of (such as verbal, ostensive, or other potentially pedagogical ones; see Gergely, Egyed, & Király, 2007)?

Further interesting questions for future research concern the broader developmental course of such selective normative learning. First, how does it emerge and develop prior to the age studied here? What might be convincing indicators of such abilities in younger children? Research on selective trust generally (without any normative learning) has produced mixed findings with 3-year-olds. (Koenig & Harris, 2005b, for example, find some competence in Study 3, but negative results in Studies 1 and 2.) Future research will hopefully shed more light on younger children's competence in selective learning in general and on their selective normative learning in particular.

Relatedly, once some competence in this domain has emerged, how does it develop further? Recent work on selective trust has just begun to document growing sophistication in this area. Once children are capable of basic selective learning, they soon become capable of relativizing competence to domains (they prefer adults' opinion on adult matters and children's opinions on childish matters; VanderBorght & Jaswal, 2007); they take into account extraneous reasons why someone might have been excusably unreliable and thus not generally a bad source of information (Nurmsoo & Robinson, in press); and they become more flexible in tracking (un-)reliability even if it is statistically not perfect (i.e., not 100% correct or incorrect; Pasquini et al., 2007). Is there analogous growing sophistication in the context of selective normative learning? Children in the present study clearly engaged in selective normative learning from a reliable over an unreliable model. But this is not always appropriate. Not all kinds of actions and circumstances admit of normative interpretation (there is no reason to expect the food preferences of a reliable model to be more "correct" than those of an unreliable one, for example). Recent research with young children has documented some rudimentary ability to distinguish between domains of individual preferences and conventional domains (e.g., Diesendruck & Markson, 2001; Graham, Stock, & Henderson, 2006; Henderson & Graham, 2005). Future research is needed to find out when children come to apply such distinctions between domains in their normative learning.

Acknowledgements

We would like to thank Claudia Salomo and Manja Teich for helping in recruiting children and collecting data. Thank you to all daycare centres and children for their friendly cooperation.

This work was supported by a *Dilthey Fellowship* of the Volkswagen Foundation and the Thyssen Foundation to the first author.

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