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Three-year-olds' spontaneous lying in a novel interaction-based paradigm and its relations to explicit skills and motivational factors

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ABSTRACT

Previous research has investigated children's lying and its motivational and social-cognitive correlates mostly through explicit tasks. The current study used an anticipatory interaction-based paradigm adopted from research with preverbal infants. We investigated 3-year-olds' spontaneous lying within interaction and its motivational basis and relations to explicit skills of lying, false belief understanding, inhibitory control, and socialization. Children interacted with puppets to secure stickers that were hidden in one of two boxes. Either a friend or a competitor puppet tried to obtain the stickers. Nearly all children helpfully provided information about the sticker's location to the friend, and about half of the sample anticipatorily provided false information to the competitor. Children misinformed the competitor significantly more often than the friend, both when the reward was for themselves and when it was for someone else. Explicitly planning to lie in response to a question occurred significantly less often but predicted spontaneous lying, as did passing the explicit standard false belief task. Thus, by 3 years of age, children spontaneously invoke false beliefs in others. This communicative skill reveals an interactional use of false belief understanding in that it requires holding one's perspective to pursue one's goal while providing a different perspective to distract a competitor. Findings support the view that practical theory of mind skills emerge for social coordination and serve as a basis for developing explicit false belief reasoning.

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Introduction

False belief understanding in interaction-based tasks

Theory of mind (ToM), the ability to predict others' behaviors by imputing mental states to others (Premack & Woodruff, 1978; see also Flavell, Green, Flavell, & Lin, 1999), enables one to flexibly adjust behaviors in the course of an interaction in order to coordinate meaningfully with others (Dennett, 1978). Mental state attributions are best revealed when they involve false beliefs because the represented content of a false belief can be distinguished from represented reality. It has remained contested, however, whether young children spontaneously represent false beliefs when interacting with other persons (Baillargeon, Scott, & He, 2010; Bloom & German, 2000; Poulin-Dubois et al., 2018; Wellman, Cross, & Watson, 2001).

Standard verbal false belief tasks assess whether children impute mental states by asking them directly (Perner & Roessler, 2012; Perner & Wimmer, 1985), with positive results around 4 or 5 years of age (Wellman et al., 2001). Thus, these tasks measure elicited reflective responses outside of direct interactions but do not tap spontaneous modifications of others' behavior within interactions. Until relatively recently, comparably less research had adopted Dennett's (1978) criteria to investigate how children spontaneously modify others' behaviors within interactive situations by anticipating others' behaviors based on false belief attributions. Lying is a natural test case of ToM given that it requires the implementation of false beliefs in others. However, as we review below, research on lying heavily rests on verbal task instructions and explicit questions and thus may be less able to capture early spontaneous use of ToM. The current study employed a novel paradigm to measure spontaneous, less explicit skills of lying within social interaction.

Liszkowski and colleagues found that 1-year-olds anticipatorily and flexibly adapt their nonverbal communication within interactions, supporting the interpretation that they anticipate a person's action based on mental state attributions. For instance, when an adult was about to retrieve an object but was mistaken about its location, 1-year-olds spontaneously provided true information; they intervened helpfully before the adult would commit the mistake. In control conditions, when the adult knew about the location or did not intend to retrieve the object, infants intervened significantly less (Knudsen & Liszkowski, 2012a, 2012b, 2013). Subsequent studies have suggested that 1.5-year-olds (Buttelmann, Carpenter, & Tomasello, 2009; Knudsen & Liszkowski, 2012a; Southgate, Chevallier, & Csibra, 2010) and 3-year-olds (Király, Oláh, Csibra, & Kovács, 2018) will indeed make appropriate inferences about a person's action, even when the person holds a false belief, and react on the basis of the person's belief, not reality. These interaction-based paradigms then provide insights into an early-emerging use of ToM within interaction before explicit tasks are mastered (Liszkowski, 2013).

However, on empirical grounds, several findings on infants' implicit ToM skills have been found to be difficult to reproduce (Crivello & Poulin-Dubois, 2018; Dörrenberg, Rakoczy, & Liszkowski, 2018; Dörrenberg, Wenzel, Proft, Rakoczy, & Liszkowski, 2019; Poulin-Dubois et al., 2018; Priewasser, Rafetseder, Gargitter, & Perner, 2018). Crucially, on conceptual grounds, they are amenable to a leaner interpretation; infants may act in these tasks by tracking an adult's knowledge state and determining the adult's goal (they understand ignorance but not false belief; Tomasello, 2018). Thus, infants may understand whether another person does or does not share a perspective with them but might not understand whether a person has a different perspective (Liszkowski, 2018); that is, they do not represent two conflicting perspectives at the same time (Moll & Meltzoff, 2011; Perner, 1991).

Lying is a much clearer case of ToM use in interaction. When lying, one does not want to share one's perspective with the other person but instead wants to provide a different (nonfactual) perspective to the other person. Thus, one intends to implant a nonfactual perspective in a recipient (i.e., a "false" belief) in order to make the recipient behave in an anticipated way so that it does not impede pursuing one's own goal (based on one's own perspective). Most research converges to show that children begin to lie around the same age when they pass the verbal standard false belief task, that is, around 4 years of age (Talwar & Crossman, 2011). However, just like verbal standard false belief tasks, evidence on lying rests heavily on paradigms that use verbal task instructions, use elicited responses, and often

require verbal lies. As with verbal standard false belief tasks, thus, these methods may be less apt to reveal spontaneous, less explicit skills of lying within social interaction. To date, paradigms for assessing spontaneous lying analogous to interaction-based tasks of spontaneous informing are still lacking.

Research on lying in children

Distinct paradigms have been used to measure lying behavior. In transgression paradigms, children are verbally instructed not to peek at a desirable object in the experimenter's absence. When being asked upon the experimenter's return, they typically deny their transgression (they answer "no"; Evans & Lee, 2013). In the disappointing gift task (Talwar & Crossman, 2011; Talwar & Lee, 2002; Talwar, Murphy, & Lee, 2007), children receive an undesirable gift, such as a bar of white soap. When being asked by the gift giver whether they like the gift, they typically deny their disappointment (they answer "yes"). Findings reveal an age-related increase of these so-called antisocial and prosocial lies, respectively, with most children lying not before 4 years of age. Antisocial lies seem to appear earlier than prosocial lies (Talwar & Crossman, 2011 Talwar, Crossman, & Wyman, 2017), perhaps reflecting socialization toward socially accepted behavior (Lavoie, Yachison, Crossman, & Talwar, 2017). Although compatible with a false belief interpretation, it is also quite possible that performance in these tasks rests on a pragmatic understanding that one should not transgress social norms and conventions. Children may attempt to undo, or withhold, a socially unfavorable perspective rather than provide a specific novel nonfactual perspective (i.e., implant a false belief). Thus, they may rather conceal factual information than provide false information, which is compatible with the interpretation that younger children's ToM involves an understanding of ignorance, not false belief (Tomasello, 2018).

Another common way of measuring lying in children is the hide-and-seek paradigm. In this paradigm, the child is typically involved in a hiding process and then explicitly is asked, or sometimes even instructed, to mislead another agent who is searching for the hidden object. With this paradigm, initial research suggested deceptive abilities in some 2- and 3-year-olds (Chandler, Fritz, & Hala, 1989), although subsequent research revealed that once appropriately controlled and compared across ages, most children have difficulties with lying in such tasks before 4 years of age (Bigelow & Dugas, 2009; Hayashi, 2017; Mascaro, Morin, & Sperber, 2016; Sodian, 1991; Sodian, Taylor, Harris, & Perner, 1991). Interestingly, younger children are able to physically prevent the competitor from obtaining the object (Peskin, 1992; Sodian, 1991); that is, they do understand the situation and act appropriately. Yet, they seem to be deficient at communicating a different perspective to the competitor. Similarly, Carlson, Moses, and Hix (1998) found that children under 4 years of age had difficulties with deceptively pointing to a false location when instructed to trick an opponent. Hala and Russell (2001) found that 3-year-olds had difficulties with employing a strategy of deceptive pointing even after a series of differentially rewarding feedback in which participants would lose a reward if they did not point deceptively. Although these studies showed that children did not lie communicatively when being explicitly instructed to do so, both studies found that children were able to use associative strategies of placing markers that would make competitors search in the marked (but false) location. Similarly, Harvey, Davoodi, and Blake (2018) found that 5-year-olds would circle a location on a map where they wanted a thief to search (falsely) for a target object. Although the response measure was nonverbal, children were verbally instructed and questioned, and they provided false information only when the hypothetical narrative verbally emphasized harm and transgression. Taken together, findings in the respective explicit tasks suggest that children younger than 4 or 5 years do not spontaneously communicate differing perspectives to implant false beliefs even when they are able to hinder a competitor from winning. Recently, Ding and colleagues (Ding, Heyman, Fu, Zhu, & Lee, 2018; Ding, Wellman, Wang, Fu, & Lee, 2015) found that 2-year-olds can discover deceptive strategies when playing the same game over a 10-day period even when they initially do not know how to deceive. In this task, children's performance was scaffolded by the experimenter and based on instructional feedback. It is less clear whether the trained competence in the task yielded a transfer such that children would spontaneously lie to others in novel situations.

Taken together, prior research has relied on paradigms that require verbal instructions or vignettes as well as explicit questions in order to elicit lying in children. There is less experimental research on a

spontaneous anticipatory use of lying within an interactional flow. Although spontaneous informing paradigms have been employed with much younger infants, there is a gap in analogous knowledge about children's spontaneous misinforming, that is, lying. Furthermore, several conventional lying paradigms are amenable to an interpretation of perspective withholding (corresponding to ignorance understanding) rather than provision of a different nonfactual perspective (corresponding to false belief understanding). In the current study, therefore, we developed an interactive lying paradigm and tested whether young children intentionally and spontaneously provide false information as indicated by unelicited, spontaneous nonverbal lying.

The current study

Our general paradigm was based on the structure of previous informative pointing paradigms (Knudsen & Liszkowski, 2012b), which refrain from behavioral instructions, hypothetical narratives, and explicit questions and allow even preverbal infants to spontaneously interact and provide information by pointing to an object's location in anticipation of an adult's goal. Our paradigm made use of puppets because protest paradigms have shown that children are not afraid to correct and stand up against competitor puppets (Rakoczy, Warneken, & Tomasello, 2008; Schmidt, Rakoczy, & Tomasello, 2013). Furthermore, Hala and Russell (2001) found that children are less prone to lie in the presence of an adult authority figure. In our interaction paradigm, children interacted with a protagonist puppet while either a competitor puppet or a friend puppet (relative to both children and the protagonist puppet) was looking for a hidden sticker. Whereas the competitor puppet aimed at stealing the sticker from children or the protagonist puppet (depending on the motivation condition; see below), the friend puppet aimed at cleaning or providing the sticker, respectively. Children knew where the sticker was hidden and could spontaneously provide truthful or false information to the puppets, withhold information, or hinder the puppets physically.

Based on previous findings with 1-year-olds (Knudsen & Liszkowski, 2012b), we expected that children would understand the friend puppet's goal and spontaneously inform the friend puppet more than misinform her about the sticker's location to help her find it. That is, we expected that children would inform the friend puppet already when it approached the scene on an arbitrary anticipation path, before it asked about the sticker's location and before it was evident from its behavior where it would look for the sticker. For the competitor puppet, we reasoned that, if children had a practical implicit ToM understanding, including the understanding of false beliefs and different perspectives, they should spontaneously provide *false* information to the competitor puppet, again in the anticipation phase before seeing the puppet approach and steal the sticker. Thus, children should misinform the competitor more than the friend. Alternatively, it could be that children operate with an understanding of ignorance (shared/not shared perspective). In that case, children would not be able to lie. However, they should withhold information about the sticker's location more often in the competitor condition compared with the friend condition; that is, they should inform the competitor less often than the friend. Finally, children could also have a less epistemic understanding of the situation and simply understand the competitor's goal. In that case, they should physically hinder the competitor to achieve his goal more so than the friend puppet. The null assumption was that children would not differentiate between the two conditions at all and would point equally often to the stickers, perhaps out of interest or in an imperative manner to obtain these.

In addition, we manipulated the motivational context of children's behaviors in the competitor and friend conditions. To this end, children in the egocentric motivation conditions could obtain the stickers for themselves (to collect them in a sticker book), whereas children in the prosocial conditions never obtained the stickers but could help the protagonist puppet obtain the stickers and collect them for herself. For the friend condition, this manipulation was not central because previous research had already shown that infants inform an ignorant person both egocentrically for their own benefit to get a toy (O'Neill, 1996) and prosocially for the benefit of the person to help her find something (Knudsen & Liszkowski, 2012b; Liszkowski, Carpenter, & Tomasello, 2008). Misinforming, however, may vary as a function of motivational context, and thus the motivational manipulation was central to the competitor conditions. Egocentric lies are often the first ones observed by parents (Newton, Reddy, & Bull, 2000; Talwar, Crossman, et al., 2017), which could suggest that initially young children spontaneously

lie for egocentric rather than prosocial purposes. In that case, we would expect young children to misinform the competitor more than the friend only in the egocentric motivation condition. On the other hand, young infants readily help others to achieve their goals in various situations such as by retrieving out-of-reach objects and opening a door for an adult when the adult's hands are full (Warneken & Tomasello, 2006) or by providing missing information (Liszkowski et al., 2006). Based on this natural tendency to help others, we reasoned that young children could also help someone by misinforming someone else so that a friend profits from the lie. For example, Harvey et al. (2018) found that 5-year-olds lied instrumentally to prevent a moral transgression on behalf of a third person. On this view, thus, children should misinform the competitor more than the friend also in the prosocial condition when only the protagonist, but not the children, will benefit from the lie by receiving stickers.

Furthermore, to better understand the spontaneous, practical, interaction-based response measure, we investigated it in relation to explicit verbally stated plans of action. To this end, in a subset of trials we elicited future hypothetical verbal responses to a verbal question about what children thought to do when the puppet appeared. That is, we asked them before they could spontaneously intervene. According to Sodian (1991), children younger than 4 years have difficulties with verbally explicating a lying strategy, although they are able to physically prevent a competitor from attaining his goal. Similarly, Rhodes and Brandone (2014) found that children spontaneously interacted appropriately based on anticipating a person's behavior, but struggled when they needed to explicitly state what the person would do next. Therefore, we expected that children have difficulties with talking about their lying, although they might nevertheless be able to spontaneously lie in the interaction paradigm. Such a dissociation would support two-system accounts that suggest a distinction between implicit and explicit ToM skills (Apperly & Butterfill, 2009; Low, Apperly, Butterfill, & Rakoczy, 2016).

Finally, we collected several correlational measures to relate children's spontaneous misinforming to established measures of explicit cognitive ToM processes and inhibitory control. Regarding ToM processes, we used a verbal knowledge–ignorance task from a standard ToM scale and an explicit standard false belief task (Hofer & Aschersleben, 2007; Perner & Wimmer, 1985; Wellman & Liu, 2004). As reviewed before, one proposition is that lying in the sense of denying rule violations requires a less complex ToM that pertains to understanding whether a person is knowledgeable or ignorant (Leduc, Williams, Gomez-Garibello, & Talwar, 2017; Ma, Evans, Liu, Luo, & Xu, 2015). In contrast, intentional lying in the sense of providing a false perspective requires the ability to implant false beliefs in others (Bigelow & Dugas, 2009; Talwar, Gordon, & Lee, 2007; Williams, Moore, Crossman, & Talwar, 2016) and has been related to explicit false belief understanding (Ding, Heyman, Sai, et al., 2018; Ma et al., 2015). If performance on a standard false belief task would correlate with spontaneous anticipatory misinforming in the interaction paradigm, this would support the interpretation that lying involves representing conflicting perspectives.

Regarding inhibitory control, we used the bear–dragon task (Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996; Reed, Pien, & Rothbart, 1984). Lying has been suggested to require inhibiting the truth in order to provide false information, and executive functions—in particular inhibitory control—have been related to the development of lying in several studies (Carlson & Moses, 2001; Carlson et al., 1998; Ding, Heyman, Sai, et al., 2018; Evans, Xu, & Lee, 2011; Hala & Russell, 2001; Talwar, Crossman, et al., 2017; Talwar & Lee, 2008). Furthermore, executive functions have been related to a number of conceptual ToM skills, including children's ability to distinguish reality from fantasy (Davoodi, Corriveau, & Harris, 2016). If the bear–dragon task correlated with spontaneous lying in the current paradigm, this would support the interpretation that lying depends not just on conceptual advances in ToM but also on domain-general processes more generally. Alternatively, spontaneous lying may be different from instructed, elicited explicit lying and may be unrelated to inhibitory skills. For example, spontaneously providing a false perspective may depend less on inhibiting one's own perspective because after all, pursuing one's own perspective is often the very reason to belie someone else.

Finally, spontaneous lying may be a function of social interactional experiences. Because it is difficult to obtain direct observational data, we used a parent questionnaire (the German extended version of the Alabama Parenting Questionnaire (GEAPQ-P-ES; Frick, 1991; Reichle & Franiek, 2009), which asked parents about their parenting styles. In addition, we administered an informal exploratory questionnaire about children's frequency of lying in daily life. Previous research has suggested

a positive relation between children's development of antisocial lying and authoritarian parenting (Baumrind, 1971), that is, exposure to a harsh and physical disciplinary parental style (Stouthamer-Loeber, 1986; Talwar & Lee, 2011). Furthermore, control parenting (e.g., criticism, behavioral control) and firm but responsive parenting (i.e. authoritative parenting) (Baumrind, 1971) are associated with a lower propensity to lie (Ma et al., 2015; Talwar, Lavoie, Garibello, & Crossman, 2017). In the current study, we continued to explore possible relations between parenting behavior and spontaneous lying. If social-interactional experiences, reflected in the form of parenting style, were related to the spontaneous use of lying, we expected positive relations between spontaneous lying and authoritarian parenting and expected negative relations between spontaneous lying and positive responsible parenting.

Method

Participants

The sample consisted of 3-year-old Caucasian children (mean age = 42.48 months, *SD* = 3.68) who were recruited from the department's database (n = 48) of parents who had agreed to participate in child studies and from day-care institutions (n = 34) in a metropolitan city in Germany. Participants were tested in the research lab and day-care centers, respectively, balanced across conditions. No socioeconomic status (SES) measures were obtained, but the estimated level was middle to high SES, and parents typically had a high school diploma and/or university degree. The final sample consisted of 82 participants (43 girls), all of whom monolingual German native speakers. In total, 50 children were included in the competitor condition (25 for prosocial motivation) and 32 children were included in the friend condition (23 for prosocial motivation).[1] Single trials (n = 7) were excluded from analyses due to parents' interference or children's unwillingness to complete the task.

Setup and materials

The interactive puppet play included three different puppets of equal size and cuteness: the protagonist puppet (''Maxi''), a fluffy friend puppet (a frog), and a fluffy competitor puppet (a bear). For ease of procedural demands, the assigned puppet roles were fixed. Piloting and previous in-lab use had revealed no systematic differences in attraction, preference, or handling of the puppets. We used eight different stickers—four in the story introduction and four in the test trials—and an empty sticker book in which to paste the stickers. The sticker book belonged either to the child (egocentric motivation) or to the protagonist Maxi (prosocial condition). Two identical boxes ($10 \times 6 \times 7$ cm) were placed on a table between the child and the experimenter with a distance of 40 cm between the boxes, equidistant to the child and experimenter. Both boxes were within reach of the child. Up to four cameras recorded the child and experimenter during the experiment.

Procedure

The study was conducted in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki). The general procedure was approved by the ethics committee of the authors' institution. Parents and their children were welcomed and led into a separate welcome room. Parents gave informed consent, and the experimenter briefly played with the child informally to warm up and establish good rapport. The experiment took place in an adjacent room. During the experiment, the child sat at a table opposite the experimenter. Parents were instructed not to interfere or interact with the child during the testing. Children first participated in the interaction paradigm. Because our main focus was on children's spontaneous behaviors in the interaction paradigm, the two ToM tasks (knowledge–ignorance task and false belief task) and the inhibition task (bear–dragon task) were

[1] Note that the motivation manipulation was only of interest for the competitor condition (see Introduction). Piloting had confirmed previous findings from the literature and revealed that spontaneous informing for egocentric purposes was trivial at this age and at ceiling.

administered in randomized order thereafter in order not to bias infants' spontaneous behavior or fatigue infants. At the end of the experiment, parents filled out the parental questionnaire about their parenting style and our informal questionnaire about children's lying in daily life.

Interaction paradigm

The procedure unfolded as uninterrupted, continuous participatory play. All puppets were acted out by the same experimenter (the first author). Children were randomly assigned to one of four conditions: competitor + egocentric motivation, competitor + prosocial motivation, friend + prosocial motivation, or friend + egocentric motivation. All conditions included two story introduction trials and four test trials.

The two introduction trials introduced the child to the general frame of the narrative, the puppet characters, their goals, and the consequences of achieving their goals and of failing to achieve their goals. Several procedural features established the puppets either as competitor or as friend. First, the puppets appeared with distinct characteristic melodies hummed by the experimenter (thrilling lower-voice melody "dumdidum" for competitor puppet; friendly clear-voice melody "lalila" for friend puppet). Second, Maxi reacted differently toward the puppets, expressing warm welcoming joy about the friend's appearance and anxious rejecting concern about the competitor's appearance. Third, the puppets' behaviors and outcomes clarified that the competitor stole stickers, whereas the friend cleaned and provided stickers. In the first introduction trial, the puppets witnessed the hiding process and found the hidden sticker. In the second introduction trial, the puppets were misled intentionally (competitor condition) or accidentally (friend condition) about the sticker's location and did not find the hidden sticker. Thus, the child was shown both possible outcomes (puppet finds sticker and puppet does not find sticker) and their consequences. The story introduction was followed by four test trials, which tested whether the child would spontaneously intervene in the story. The puppet play started with the presentation of the protagonist puppet Maxi in all conditions. The exact script is reported in the Appendix.

Competitor condition + egocentric motivation. In the introduction phase, the child received a sticker book and could paste two stickers into her or his book. Maxi brought out a new sticker. Then, the competitor puppet appeared from the side with his characteristic lower-voice melody hummed by the experimenter ("dumdidum"). Maxi expressed anxious concern ("Oh, no ..."; see Appendix). To hide the sticker, Maxi opened one of the two boxes, soliciting help from the child, and put the sticker into the box. The competitor puppet was watching the hiding from the edge of the table. Then, Maxi excused himself and briefly left. In his absence, the competitor blackguardly went for the box with the sticker, took the box with the sticker, and left. Then, Maxi returned with the empty box, which he had apparently found under the table on his way back. Maxi expressed frustration and showed the empty box to the child ("Oh no. The bear stole your sticker and you cannot paste it into your book!"). The second introduction trial unfolded as the first trial. Maxi brought out a new sticker and, again, the competitor puppet appeared. However, this time Maxi tricked the competitor by only pretending to insert the sticker into one of the boxes, acting knowingly and deceitfully toward the child ("Ssh ... look ..."), and really took the sticker with him. As before, the competitor took the box, but it was empty. Then, Maxi returned with the box as before and expressed joy and triumph that he still had the sticker and that he had "tricked" the bear. Then, he gave the sticker to the child, who could paste it into her or his book.

In the following four test trials, Maxi brought out a new sticker and secured it right away in one of the boxes (locations alternated) *before* the competitor appeared. Thus, the competitor never knew where the sticker was. Then, Maxi asked in a rather rhetorical manner, "Should the bear find the sticker?" and corrected the child if she gave an incorrect answer or did not answer (Rubio-Fernández, 2013) in order to ensure that the child stayed on task. Incorrect answers were rare, indicating that children followed the story. In two of four test trials, Maxi asked the child a future hypothetical question just before the competitor would appear ("If the bear appears, what will you do?"). Future hypothetical questions were asked either in the first two trials or in the last two trials, counterbalanced across children. Then, Maxi left and the competitor appeared, first announced by the melody. Three phases of approach ensued (Knudsen & Liszkowski, 2012b). In the anticipation phase

(~16 s), the competitor appeared with the specific melody and looked around, slowly approaching the scene (see Fig. 1). In the question phase (~16 s), the competitor stopped, looked around, and asked himself, "Hmm, where is the sticker?" In the choice phase (~16 s), the competitor decisively (but slowly) approached the box with the sticker. Whenever the child indicated a box through attention-directing behavior, such as pointing or moving the relevant box closer, the competitor went in that direction and the choice phase started. Hence, durations of the phases could vary, and the question phase was skipped if the child already communicated during the anticipation phase. Only if the child misinformed or hindered the competitor did the child receive the sticker at the end of each trial.

Competitor condition + prosocial motivation. The main procedure was identical to the competitor condition + egocentric motivation except that in the story introduction Maxi presented *his* sticker book and pasted two stickers into his book. The child never obtained any stickers. If the child misinformed or hindered the competitor puppet in the test trials, Maxi—but not the child—received the stickers and pasted them into his book at the end of each trial.

Friend condition + egocentric motivation. The main procedure was identical to the competitor condition + egocentric motivation and matched in all relevant steps. The child received a sticker book and two stickers from the friend puppet, which the child could paste into her or his own book. In the first introduction trial, Maxi brought out a new sticker. Then, the friend puppet appeared with her characteristic clear-voice melody ("lalila"). Maxi expressed joy ("Ah, Froggy . . .") and opened one of the two boxes, soliciting help from the child, and put the sticker into the box while the friend was watching. Then, Maxi excused himself and briefly left. In his absence, the friend went for the box with the sticker, took the box with the sticker, and left (matched to the competitor condition). The friend then returned with the sticker, which he had retrieved from the box, and gave it to the child, who could paste the sticker into her or his book. Then, the friend left, and Maxi returned happily with

Fig. 1. General setup of the paradigm.

the box, which was now empty, and showed it to the child ("Great. The friend found the sticker and gave it to you so you can paste it into your book!"). In the second introduction trial, Maxi brought out a new sticker. Again, the friend puppet appeared. This time, Maxi accidentally dropped the sticker behind the box without noticing (matched to the competitor condition). Consequently, the friend took the empty box, not seeing the sticker behind it, and could not give the sticker to the child. When Maxi returned, he saw the sticker left on the table, expressed mild frustration, was sorry ("Oh, what a pity . . ."), and removed the sticker. The ensuing four test trials were identical to the competitor conditions.

Friend condition + prosocial motivation. The main procedure was identical to the friend condition + ego centric motivation except that in the story introduction the friend presented his sticker book and pasted two stickers in into his book. If the child informed the friend puppet in the test trials, the friend received a sticker to paste into his book at the end of each trial. The child never obtained any stickers.

Theory of mind

Children completed a Knowledge–ignorance task (Hofer & Aschersleben, 2007; Wellman & Liu, 2004) as well as an explicit false belief task (Wimmer & Perner, 1983). In the knowledge–ignorance task, the child needed to judge whether another girl knew what was in a drawer (a dog) when only the child had seen inside. The child passed the task when answering the target question correctly: "Does the girl know what's in the drawer?" (control question: "Has she ever seen inside?"). In the false belief task, the experimenter told the child a story about Sally, who put her ball into a basket. In her absence, Sally's little brother put the ball from the basket into the box, saying "Ssh." We added this deceptive element to enhance children's performance on the false belief task (Sullivan & Winner, 1991; Wellman et al., 2001). When Sally came back to play with her ball, the experimenter asked the child the belief question ("Where will Sally look for her ball?") followed by the reality question ("Where is the ball now?"). The child passed the task when answering the belief question correctly.

Inhibitory control

To measure inhibitory control, we used an adapted version of the bear–dragon task (originally developed by Reed et al. (1984) and adapted by Kochanska et al. (1996)). We replaced the original bear and dragon puppet with a monkey and lynx puppet to avoid an overlap with the puppets of the puppet play. To ensure that the child was able to carry out simple movements or gestures, the child was asked to perform five movements such as "Stretch your arms." Then, the experimenter introduced a monkey (good puppet) and a lynx (mean puppet) by saying, "The monkey is very nice; we do everything he says because he's our friend. But this nasty old lynx isn't our friend at all. We do not do what he says." Thus, in this task, children should follow the instructions of the monkey but inhibit the instructions of the lynx. Two practice trials followed. First, the experimenter animated the monkey, spoke on his behalf with a friendly high-pitched voice, and gave one command ("Put your hand on your belly"). Second, the experimenter animated the lynx, spoke with a low gruff voice, and said, for example, "Nod with your head." If the child failed this lynx trial three times (i.e., if the child enacted the behavior), the experimenter gave negative feedback and repeated the rules. The child got up to five practice trials. Before the test trials started, the child's rule comprehension was checked by asking, "If the monkey asks you to do something, are you going to do it?" and "If the lynx asks you to do something, are you going to do it?" Then, 10 test trials (5 monkey and 5 lynx test trials) followed in alternating order. After the fifth trial, the experimenter reminded the child of the rules of this game.

Parental questionnaire

Parents filled out an informal parental questionnaire at the lab or online after the experiment. The parental questionnaire contained questions about lying behavior at home. Parents were asked whether or not they had already observed their child attempting to lie at home, how frequently this occurred during the last month (fewer than three times, three to five times, six to eight times, or more than eight times), and what they assumed to be the reason for their child's attempts to lie (fixed categories: fun, avoidance of punishment, material gain, or other). The questionnaire further included five scales of the GEAPQ-P-ES (Frick, 1991; Reichle & Franiek, 2009) measuring self-reported parenting style on a 5-point Likert scale ranging from *never* to *always.* Only the age-relevant scales Positive

Parenting Behavior, Authoritarian Parenting, Responsible Parenting, Inconsistent Discipline, and Corporal Punishment were included in the parental questionnaire.

Coding and reliability

For the interaction paradigm, behavior was coded with Mangold INTERACT (Version 18). A rater who was naïve to the hypothesis coded children's communicative behaviors and physically hindering behaviors. Communicative behavior was coded when it was clearly directed to the puppet. We differentiated between informing communication enabling the puppet to achieve her goal and misinforming communication leading the puppet to act against her goal. Not providing information corresponded to withholding information. We coded attention-directing deictic gestures (e.g., pointing, tapping, showing, offering). To obtain additional information about the child's communicative intent, we transcribed relevant verbal comments and coded whether they included information regarding the object (e.g., "The sticker is in this box," "The sticker is gone") or actions (e.g., "Look here," "Go there"). Gestures and verbal comments were coded independently, although they often co-occurred.

Physically hindering actions were coded when they clearly hindered the puppet to achieve her goal through the child's direct physical object-directed actions (e.g., blocking access to sticker box, holding up the puppet; removing the sticker box). In contrast to communication, hindering actions were not communicative and did not depend on the puppet's presence. The occurrences of behaviors were coded for each phase separately. Different behaviors could occur in the same trial and phase. Latency of each behavior was coded as the time interval between the beginning of the anticipation phase indicated by the start of the puppet's melody and the first occurrence of the behavior.

For the inhibitory control task, we used the same coding scheme as Kochanska et al. (1996) and Sabbagh et al. (2006). For each lynx trial, children received a score ranging from 0 to 3. Children failed a trial and received a score of 0 if they followed the instructions and fully carried out the target action. Children received a score of 1 if they partially carried out the target action, a score of 2 if they carried out a different action instead, and a score of 3 if they did not carry out but rather inhibited the commanded action. A sum score ranging from 0 to 15 was computed for the lynx and monkey trials separately. The lynx sum score was considered the inhibition score.

An independent rater recoded 25% of the videos for interrater reliability. Interrater reliability for the interaction paradigm, based on a 2-s time frame, was excellent, with Cohen's κ = .94. Interrater reliability for all cognitive tasks was excellent, with Cohen's κ = .83 for knowledge–ignorance, Cohen's κ = .97 for false belief, and Cohen's κ = .84 for inhibitory control.

Analytic strategy

Preliminary analyses on our main dependent measures, communication and hindering actions, revealed no significant differences between testing location (research lab vs. day-care center), gender, or trial order (future hypothetical trials first vs. second) (*t* tests, *ns*). Thus, data were collapsed across testing location, gender, and order. In our first set of analyses, we analyzed our main dependent variables informing, misinforming, and hindering between conditions and motivations using an omnibus 3 (Behaviors) $\times$ 2 (Conditions) $\times$ 2 (Motivation) analysis of covariance (ANCOVA) with age as a covariate. Regarding motivation, planned directed comparisons tested whether children misinformed the competitor more than the friend in the prosocial motivation condition and in the egocentric motivation condition. To assess whether behavior was indeed spontaneous, we ran the analyses for the anticipation phase only before the puppets revealed their action. To test whether competence was not just an artifact of repeated trials, we repeated the analyses on the first trial only and we checked for learning across trials. To assess the communicativeness of informing and misinforming behavior, we characterized act-accompanying features such as gesture, accompanying verbal comments, and latency.

Next, we analyzed children's explicit verbal responses to the future hypothetical questions. Then, we tested whether children's ToM, inhibitory control, and explicit answers were predictive for spontaneous lying. Finally, we analyzed social factors to explore potential relations between parenting styles and spontaneous lying.

Results

Communication and physical intervention

Fig. 2 presents the mean proportion of trials with the different behaviors in the competitor and friend conditions. A 3 (Behavior: informing, misinforming, or hindering) × 2 (Condition: competitor or friend) × 2 (Motivation: egocentric or prosocial) ANCOVA with age in months as a covariate revealed a significant interaction between condition and behavior, $F(2, 77) = 22.98$, $p < .001$, $\eta^2 = .23$, and among the three factors, $F(2, 77) = 4.05$, $p = .019$, $\eta^2 = .05$. Age had no effect as a covariate.

Resolving the significant interaction terms according to our predictions revealed that children misinformed the competitor significantly more often than the friend (mean difference = .29, $p < .001$, 95% confidence interval (CI) [0.14, 0.44]). Furthermore, children withheld information more often (i.e., they informed less) in the competitor condition than in the friend condition (mean difference = .42, $p < .001$, 95% CI [0.15, 0.50]). Children also hindered the competitor more often than the friend (mean difference = .32, $p = .001$, 95% CI [.15, .5]). Our control comparisons further confirmed that in the friend condition children more frequently informed than misinformed (mean difference = .85, $p < .001$, 95% CI [0.64, 1.10]) and hindered (mean difference = .85, $p < .001$, 95% CI [0.62, 1.10]). In the competitor conditions, the frequencies of behaviors were not significantly different from each other.

Planned directed comparisons revealed that children misinformed the competitor more often than the friend in the prosocial motivation condition, $t(35) = 2.34$, $p = .025$, $d = 0.78$, mean difference = .17, 95%, CI [0.02, 0.32], and in the egocentric motivation condition, $t(24) = 5.09$, $p < .001$, $d = 2.04$, mean difference = .42, 95% CI [0.25, 0.59]. Furthermore, pairwise comparisons revealed more misinforming and less informing in the egocentric motivation condition than in the prosocial motivation condition (mean difference = .19, $p = .029$, 95% CI [0.02, 0.36] and mean difference = .23, $p = .032$, 95% CI [0.02, 0.44], respectively).

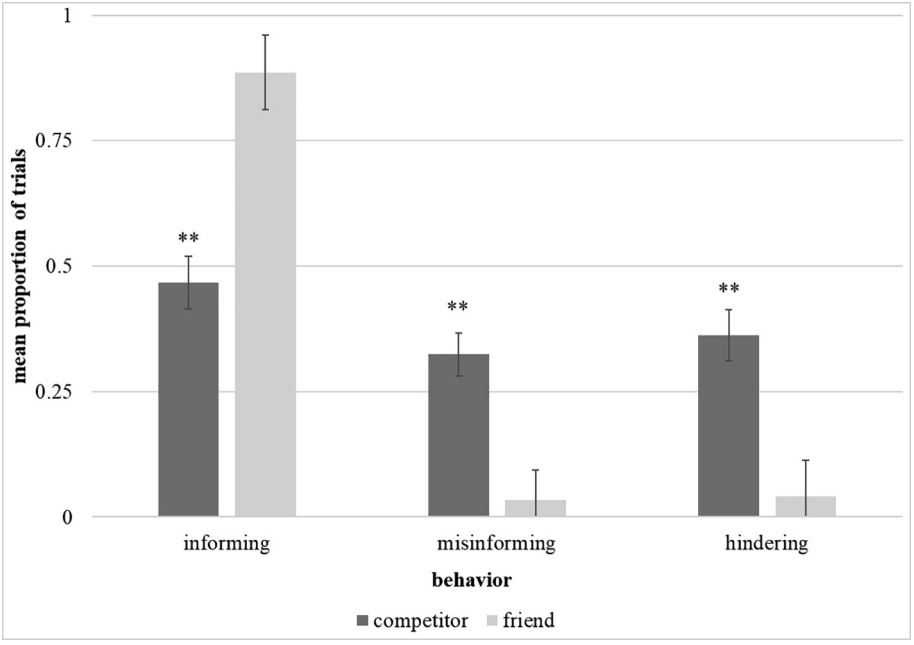

Fig. 2. Mean proportions of trials with informing, misinforming, and physical hindering in the competitor and friend conditions. Error bars depict standard errors of the mean. **Significantly different from adjacent bar ($p < .001$).

The effects of misinforming and hindering were already present in the anticipation phase [3 × 2 analysis of variance [ANOVA]; interaction term: Condition × Behavior, $F(2, 80) = 7.81$, $p = .001$, $\eta^2 = .089$]. Children misinformed and hindered the competitor more often than the friend (mean difference = .19, $p = .001$, 95% CI [0.08, 0.31] and mean difference = .32, $p = .001$, 95% CI [0.13, 0.50], respectively). A similar pattern was already present in the first trial [Condition × Behavior: $F(2, 80) = 3.69$, $p = .027$, $\eta^2 = .044$]. Children misinformed and hindered the competitor more often than the friend (mean difference = .46, $p = .029$, 95% CI [0.05, 0.86] and mean difference = .65, $p = .004$, 95% CI [0.21, 1.10], respectively). Furthermore, an analysis of the frequency of misinforming across trials with a 4 (Trial) × 2 (Condition) ANOVA revealed no changes across trials.

Additional behavioral characteristics

Next, we analyzed further characteristics of children's communication and physical interventions. Latencies distinguished hindering from misinforming; latencies for misinforming were longer than those for hindering, $t(17) = 3.70$, $p = .002$, $d = 0.90$, mean difference = 13.56, 95% CI [5.83, 21.29]. Furthermore, latencies distinguished informing the friend from informing the competitor; children were faster to inform the friend than to inform the competitor, $t(59) = 2.05$, $p = .036$, $d = 0.53$, mean difference = 4.85, 95% CI [0.32, 9.38]. No further latency effects emerged. Misinforming was mostly gestural (78% of all trials with misinforming), sometimes accompanied by verbal comments (40%), and less often verbal only (22%). Informing was predominantly gestural (98% of all trials with informing), again accompanied by verbal comments (41%) but rarely verbal only (2%), suggesting that children invested more communicative effort when misinforming. When looking at the kinds of verbal comments, they were mostly about the object (e.g. "The sticker is in there") rather than about the puppet's action (e.g., "Take this box") for both misinforming, $t(13) = 2.72$, $p = .018$, $d = 0.75$, mean difference = 1.21, 95% CI [0.25, 2.18], and informing, $t(28) = 6.71$, $p < .001$, $d = 1.27$, mean difference = 2.31, 95% CI [1.61, 3.02], suggesting that communication was not just a directive in the sense of commanding action.

Individual performance

Overall, 54% of children misinformed the competitor at least once, whereas only 4 children (12.5%) misinformed the friend at least once (presumably accidentally) (Fisher's exact test, $p < .001$). In addition, 38% withheld information from the competitor at least once, whereas only 6% of children withheld information from the friend at least once (Fisher's exact test, $p < .01$). Half of children (50%) physically hindered the competitor at least once, with 17 children (34%) combining hindering and misinforming. In the egocentric motivation condition, 60% of children misinformed the competitor at least once and no one misinformed the friend (Fisher's exact test, $p < .01$). In the prosocial motivation condition, 36% misinformed the competitor and 13% misinformed the friend (Fisher's exact test, $p = .10$).

Future hypothetical question

Children reported to misinform, $t(63) = 2.64$, $p = .01$, $d = 0.67$, mean difference = .11, 95% CI [0.03, 0.19], and to hinder, $t(54) = 4.52$, $p < .001$, $d = 1.23$, mean difference = .28, 95% CI [0.16, 0.40], more often in the competitor condition than in the friend condition. They reported to inform more often in the friend condition than in the competitor condition, $t(31) = 3.63$, $p = .001$, $d = 1.21$, mean difference = .28, 95% CI [0.12, 0.44]. However, the proportion of actually misinforming was significantly greater than the proportion of reporting to misinform, $t(48) = 3.34$, $p = .002$, $d = 0.48$, mean difference = .19, 95% CI [0.07, 0.31]. Similarly, the proportion of actually informing was significantly greater than the proportion of reporting to inform, $t(31) = 6.33$, $p < .001$, $d = 1.14$, mean difference = .59, 95% CI [0.40, 0.78]. Overall, only a few children (20%) reported to misinform the competitor [significantly below chance, exact binomial $p(49) < .001$] or to hinder the competitor [37%, exact binomial $p(49) = .085$]. No child reported to inform the competitor. In the friend condition, 31% of children reported to inform the friend [exact binomial $p(32) = .05$] and only 1 child reported to misinform the friend [significantly below chance, exact binomial $p(32) < .001$].

Social and cognitive correlates

In total, 41% of children passed the knowledge–ignorance task (55% in the competitor condition), with 97% also answering the control question correctly, and 38% passed the false belief task (44% in the competitor condition), with 93% also answering the reality question correctly. The number of children who passed the knowledge–ignorance task was positively related to the number of children who passed the false belief task, $\varphi(78) = .305$, $p = .007$. The overall inhibition score ranged from 0 to 15 ($M = 8.25$, $SD = 5.78$).

We performed a logistic regression model to predict the effects of knowledge–ignorance understanding (passed vs. failed), false belief understanding (passed vs. failed), the inhibition score and future hypothetical answers (reported to misinform vs. did not report to misinform) on the likelihood that a child misinformed in the competitor condition. Tolerance values were above .80 and variance inflation factor (VIF) values were below 1.30, allowing for the inclusion of all predictors. The logistic model was statistically significant, $\chi^2(4) = 12.30$, $p = .015$, and explained 38% (Nagelkerke R^2) of the variance and correctly classified 78% of cases. There was a significant effect of false belief understanding ($\beta = 1.93$, $p = .038$, 95% CI [1.11, 43.00]). Children who passed the false belief test were more likely to lie than children who failed the task. Future hypothetical answers ($\beta = 2.99$, $p = .019$, 95% CI [1.64, 241.43]) were also a significant predictor, with children who explicitly stated that they would misinform being more likely to actually misinform the competitor. Children who reported to lie in the future hypothetical questions were not related to children who passed the explicit false belief task, $\varphi(47) = .002$, $p = .987$.

In our informal parental questionnaire, 48 of 60 parents reported that they had observed their child to lie in daily life. Reasons for lying behavior were various: fun (29 parents), avoidance of punishment (21 parents), and material gain (20 parents). Most children were reported to lie fewer than three times (18 children) or three to five times (17 children) in the last month, and 14 children were estimated to lie more than six times in the last month. Lying children in the competitor condition were not classified as lying children by parents' report, $\varphi(29) = -.35$, $p = .058$. We found no relation between lying rates and parenting styles (all correlations, *ns*).

Discussion

The 3-year-olds in the current study spontaneously communicated information to others that was either true or false. The paradigm was analogous to an interaction-based paradigm, which had shown that younger infants communicate spontaneously truthful information in anticipation of helping others (Knudsen & Liszkowski, 2012a, 2012b). Of interest for the current study was whether children also communicate spontaneously false information to someone in order to provide that person with a different perspective that would prevent the person from acting according to current reality. Previous studies had mostly used explicit paradigms with instructed or verbally elicited measures outside the spontaneous flow of an ongoing interaction, suggesting that explicit use of communicative lying emerges around 4 years of age (Sodian, 1991). The current study reveals that 3-year-olds have the practical skills to provide false information within an ongoing interaction with the apparent intention to induce a false belief in the recipient. At the same time, their explicit skills are still less pronounced.

Importantly, children did not err randomly about the object's true location, which is evident from the significant difference between conditions. Our further analyses showed that children were indeed communicating false information rather than just physically hindering the competitor from reaching his goal. First, misinforming entailed attention-directing gestures, typically distal pointing acts, often accompanied by verbal comments, which are clearly distinct from physically holding up the competitor or securing the box. Latency results further distinguished misinforming from physical hindering. Second, the verbal comments were mostly about the object, as one would also typically interpret nonverbal pointing acts, and not about directing actions. Thus, although one could argue that children simply wanted the competitor to go to the other side (or stay away from the object), the way in which children achieved this was neither through simple physical intervention alone nor through imperatively commanding the competitor to act. Instead, children clearly belied the competitor about an aspect of reality. Importantly, children misinformed already in the anticipation phase, before they

could see what the competitor would do, excluding the possibility that children were only reacting based on the competitor's perceivable behavior. Instead, they anticipated the competitor's action and acted on that representation accordingly (see Dennett's (1978) analysis of false belief assessment). Finally, children's spontaneous behaviors were not a result of learning across trials given that the effect was already present in the first trial and did not increase across trials.

Cognitively, this must suggest that children represented their own perspective (to pursue their goal) while simultaneously providing the competitor with a different perspective (to make him act on the false belief), a core definitional aspect of false belief understanding (Perner, 1991; Tomasello, 2018). In contrast, if children had only operated with an understanding of ignorance (i.e., whether a perspective is or is not shared), then they should have only withheld information from the competitor. This was not the case. The current findings show that children not only withheld information but also provided *false* information.

The current study cannot conclusively speak to the emergence of spontaneous misinforming. However, in the current paradigm, about half of the 3-year-olds lied, whereas nearly all of them helpfully informed. This suggests a much stronger tendency to share the same perspective than to provide a different perspective. This is in line with ontogenetic findings showing that infants align perspectives from early on (Liszkowski, 2018), whereas understanding contrasting perspectives emerges later in development (Moll & Tomasello, 2006). Of course, a difference in the occurrence of informing versus lying in itself does not indicate a reduced competence to lie or, by extension, a lack of false belief understanding. However, we found that in the competitor condition itself, when informing the thief was detrimental to pursuing one's goal, children still informed as much as they misinformed. This suggests that by 3 years of age, children's skills for lying and competing are not yet fully developed. Considering our correlational finding with the standard false belief task, a developmental pattern of a gradual emergence of lying may also support accounts of gradual development of false belief understanding and render early, or innate, false belief understanding less likely, at least in the sense of contrasting two perspectives. Two results suggest that 3-year-olds begin to control their natural tendency to truthfully share information. First, when children informed the competitor, they did so more hesitantly than when they informed the friend, as revealed by significantly longer latencies. Second, children kept silent significantly more often than succumbing to the tendency to inform in the competitor condition compared with the friend condition.

Apart from communicating, physical hindering was also an option in the current design. Interestingly, there was no evidence that physical hindering was much easier or more frequent than communicative lying. In the current design, the scenery with the boxes was within children's reach, thereby enabling children to intervene physically. A procedural change of increasing the distance to the boxes could possibly prevent children from intervening physically and lead to slightly higher rates of lying. Our findings that there was no clear advantage of hindering over lying, that about half of the sample engaged in either one or both behaviors, and that about half of the children did not hinder and instead accepted the negative consequences suggest that 3-year-olds are still less competitive overall, especially in light of their ceiling performance at spontaneous helping.

In that regard, it is of interest that children also lied to help a friend and not only to increase their own personal benefit. Although the effects were more pronounced in the egocentric conditions than in the prosocial conditions, our central planned comparison confirmed more lying in the prosocial competitor condition than in the prosocial friend condition. This finding of helpful lying extends previous work on interventional prosocial lying in older children (Harvey et al., 2018) and shows that younger children misled other persons for the benefit of a familiar interactant.

One suggestion, then, is that lying derives from a form of coordinative cooperative management of perspectives for various benefits, naturally for one's own material benefit but also to adhere to conventions of politeness (Talwar, Murphy, et al., 2007) and to help someone else, as the current findings demonstrate.

How does children's spontaneous lying relate to their explicit skills and knowledge? In support of previous findings (Sodian, 1991), we found that when children were directly asked, only a minority explicitly stated that they would provide false information. In the current study, actual misinforming occurred significantly more often than explicit statements, revealing that children have advanced practical skills. This finding is in line with a recent study (Rhodes & Brandone, 2014) showing that

3-year-olds more readily inform a person in anticipation of her erring than they adequately answer an explicit question about the person's false belief. Thus, our findings reveal that 3-year-olds have less explicit access to their practical skills at communicating with others. The current findings of correlations between practical and explicit skills then suggest that explicit skills emerge through practical use of communication and social cognition. As we have argued before, lying in the sense of providing a false perspective goes beyond simple assertion or denial of conventional perspectives, and it clearly involves a grasp of contrasting perspectives. Our finding of a correlation between lying and passing the explicit false belief task provides empirical support for this conceptual analysis. Although a developmental direction of this synchronous correlation must be interpreted with caution, children's advanced practical skills relative to their explicit skills suggest that practical skills at spontaneously providing false information in ongoing interactions provide a matrix for then talking and then explicitly reasoning about others' minds (Liszkowski, 2013).

One could have expected correlations with children's inhibitory skills as well as children's socialization experiences. It is quite possible, however, that the current inhibition task did not adequately tap into the cognitive components of inhibiting a natural habit to share perspectives. It is also possible that spontaneous lying within the interactional flow rather requires activating an alternative perspective than inhibiting the current perspective, which in fact one continues to pursue. Our informal parent questionnaire on frequency and use of lying did not yield interpretable relations. It is likely that it did not adequately reflect quotidian interactional experiences and practices. For example, based on informal chatting, one impression was that parents saw lying as a desirable cognitive milestone ("My child does it already"), which could lead to an overestimation of lying. We did not find any relation between parenting styles and lying, which might be due to social desirability issues or to the questionnaire we used. The lack of relations to specific parenting styles could also indicate the pervasiveness of lying for various motives as a form of communicative perspective management.

Conclusions

Children spontaneously provide information for others from early on in life, based on skills and motivations to share and align perspectives. The current study shows that by 3 years of age, children begin to spontaneously provide false information. This form of communicative lying is based on an emerging understanding of perspective differences, the understanding that others will act on their subjective representations of reality, which can be altered in order to coordinate each other's behaviors in social settings. The findings provide a convincing case for interaction-based use of understanding different perspectives, which may be at the heart of an ontogenetic construction process of explicit false belief reasoning as a product of social interaction.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jecp.2021.105125.

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