Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

The development of lying in young children

Dissertation

zur Erlangung des akademischen Grades

Doctor rerum naturalium (Dr. rer. nat.)

an der Universität Hamburg

Fakultät für Psychologie und Bewegungswissenschaft

Institut für Psychologie

vorgelegt von

Mareike Klafka

Hamburg, 2021

Promotionsprüfungsausschuss:

Vorsitzende:	PD Dr. Kirsten Hötting
1. Dissertationsgutachter:	Prof. Dr. Ulf Liszkowski
2. Dissertationsgutachter:	Prof. Dr. Michael Tomasello
1. Disputationsgutachterin:	Prof. Dr. Nale Lehmann-Willenbrock
2. Disputationsgutachterin:	Prof. Dr. Jenny Wagner
3. Disputationsgutachterin:	Prof. Dr. Brigitte Röder

Tag der Disputation: 22.06.2021

“The false is nothing but an imitation of the true.”

Marcus Tullius Cicero

Acknowledgments

The last three years have been a wonderful time in my life, and I deeply appreciate the support from so many great individuals who have helped me along this journey.

First, I would like to thank my supervisor Prof. Dr. Ulf Liszkowski for his academic support and patient guidance during the last three years. I am grateful for his expertise and for the opportunities he has given me to attend many interesting national and international conferences. Thank you for allowing me to supervise students and to develop my passion for teaching. I look forward to many more years of collaboration.

One part of this journey was a wonderful stay at Duke University in NC, USA. I wish to extend heartfelt thanks to Prof. Dr. Michael Tomasello for sharing not only his expertise but also helpful and constructive advice on my research and ideas. My gratitude also extends to my colleagues Wouter, Leon, and Jared. Thank you for inspiring and motivating me while I was at Duke.

Thank you, Daniela, for your continuous support and patience. You are a true friend and colleague. I look forward to mastering many more challenges together. Thanks to my colleagues Rémi, Sebastian, Sriranjani, Marianna, Johanna, Katharina, Marlena, Dennis and Anke. I enjoyed each lunchbreak, conference and celebration with you (including “Werewolf”).

Thank you to Brandi and Michael for their constructive feedback on my dissertation. Last but not least, I am deeply grateful for the ever-loving and caring support of my partner, family, and friends. I don’t know where I would be without their constant encouragement and confidence in me over the last three years.

Abstract

A child's understanding of the mind emerges long before language and entails the exchange of perspectives with others. Previous research suggests that the ability to implant false perspectives (i.e., to lie) emerges only later in ontogeny. However, it remains a topic of debate whether conventional lying tasks are adequate and valid measures for a child's understanding and ability to manipulate the minds of others. Therefore, this dissertation aims to investigate the motivational, social, and cognitive foundations of spontaneous lying by children, as well as how lying develops within interactional flows. In Study 1, I present a new interactive paradigm for measuring spontaneous lying in 3-year-old children. Study further investigates the role of motivational, and social-cognitive factors as well as the ability to talk about lying explicitly. Study 2 expands on spontaneous lying in 2-year-olds. Study 3 explores whether children spontaneously adapt their lies to the recipient's epistemic state. Finally, Study 4 focuses on how children lie in order to manage their reputation among peers. Findings of Study 1 reveal that 3-year-olds lie for the benefit of another person but still struggle to speak about their lies explicitly. Spontaneous lying is related to false-belief understanding. Moreover, Study 2 suggests that selective lying is present at 3 but not at 2 years of age. Findings from Study 3 further suggest that at age 4, children adapt their lying to the epistemic states of others. As evident from Study 4, children begin to lie for reputational purposes from 5 years of age. I conclude that the spontaneous usage of perspective exchange and perspective contrasting is likely a seed of early Theory of Mind that emerges as a constructed product of social interaction.

Keywords: Spontaneous Lying, Communication, Theory of Mind, Reputation Management

Table of contents

List of Figures

List of Tables

1. Introduction

Communication is an essential part of interpersonal interaction and describes the process of intentionally sharing information, tasks, and goals between different individuals. Humans are naturally driven to cooperate and engage with one another in cooperative communication, characterized by the alignment of mental states between individuals (Vasil et al., 2020). Uniquely human forms of cooperative communication exist already in the first year of life when infants point to help another or engage in joint attentional interactions using referential communication to align another's attention to a specific object or event (Tomasello, 1998, 2008, 2018). Human motivation to engage in cooperative communication may result from evolutionary pressure to participate in collaborative and inter-dependent foraging.

However, being inter-dependent with another person makes us vulnerable to misinformation. While many organisms practice deception by camouflage or mimicry, no other species can lie intentionally during social interactions in such complex ways as do humans (Bond & Robinson, 1988). Lying is a ubiquitous human behavior that occurs in various social contexts for a multitude of purposes. It can be described as the successful or unsuccessful attempt to communicate belief-based information, with the intention of getting another to believe it to be true (Kupfer, 1982; Mahon, 2008). On average, adults lie several times per day during the course of their interactions (DePaulo et al., 1996). This begs the question: what makes us able to lie to one another? How do human cognition and ontogeny differ from that of other primates in ways that influence our ability to lie?

Cognitively, lying requires multi-perspectival and multi-propositional representations, such as what others think or believe. Great apes operate with relatively

abstract cognitive representations about what others know or do not know and are able to make simple intentional or logical inferences (e.g., inferring from the perceptions of others to their actions or vice versa) (Tomasello, 2019). In contrast, human toddlers make recursive inferences when communicating with others (e.g., about what others intend with their behavior). From about 3 years of age, children have perspectival and propositional cognitive representations about the world and about what others think; they start to take normative ('objective') perspectives on things (Tomasello, 2019). This suggests that humans are born with unique cognitive adaptations that enable them to cooperate with other individuals and to communicate in novel ways such as lying. This differs from collaboration among great apes.

Dishonesty is a common social phenomenon that opens numerous possibilities for manipulating the behavior of others and for reaching material or social goals. However, it is also a morally complex behavior. Whether lying is justifiable remains the subject of much debate. On the one hand, antisocial or 'black' lies, told for self-serving purposes (e.g., to get out of trouble or punish another), are considered harmful to relationships and are thus socially discouraged (Talwar & Crossman, 2011). On the other hand, there are many situations in which lying is considered socially acceptable and even encouraged (e.g., complimenting the cooking of a friend when the meal was, in fact, not delicious). Such 'white' lies are socially and morally acceptable because they are told for another's benefit, motivated by a desire to protect feelings and refrain from sharing hurtful information. Thus, dishonesty may well constitute an important aspect of prosocial behavior, such as helping or empathy, when it serves to protect the feelings of others. The paradox of lying is that it is both desirable and reprehensible at the same time (Talwar & Crossman, 2011). Our conflicting feelings about lies may

reflect divergent but evolutionarily embedded needs to, on one hand, form trust, and on the other, social harmony (Lewis, 2015). In general, one might suppose that lies serve a social function and follow rules within a socio-cultural context (K. Lee, 2013). Studies suggest that perceptions about the acceptability of lies vary depending on motivation for the lie and cultural background (Seiter et al., 2002). Individuals from collectivistic and individualistic cultures will, for instance, perceive the acceptability of lies in the same social context very differently.

Despite the fact that lying is a unique and ubiquitous human behavior, much uncertainty exists about its developmental origins. When and for what reasons does it emerge? Which cognitive abilities support lying, and how does it evolve into the full-fledged and diverse adult-like behavior? This dissertation seeks to contribute to deeper and more comprehensive insights into the developmental understanding of how children spontaneously attempt to manipulate the minds of others. First, I will systematically review the literature about the development of dishonesty in children with the aim of providing an overview of their comprehension and production of lies. Second, I will address the primary purpose and research questions undergirding this dissertation. Third, I will present four studies, which aim at answering the aforementioned research questions. The final chapter synthesizes theoretical and empirical strands together in a discussion of implications for future research.

1.1. Children's comprehension of lies

Trust is fundamental to cooperation as it allows the exchange of relevant information, the ability to work together, and the formation of relationships; it is crucial for successful cooperation on personal, societal, and cultural levels (Tomasello, 2019). Blind trust in others is, on the other hand, evolutionarily less appropriate as dependence

on unreliable partners could prove dangerous or even lethal. Thus, learning to trust selectively is a key element in human ontogeny and essential for cooperation. Furthermore, the ability to distinguish truth from falsehood is not only critical for the detection of deception in potential collaborators, but it is also a prerequisite for intentional lying.

Research on search- (Varró-Horváth et al., 2017) and looking-time tasks (Scott et al., 2015) suggests that in their second year of life, infants are able to discriminate between reliable and deceptive actions by others. For instance, Scott et al. (2015) conducted a study where 17-months-olds watched a thief secretly steal a toy while its owner was away, substituting it with another toy. The infants understood that the swap would only be effective in deceiving the owner if the substitute was visually identical to the original and if the owner did not shake the toy upon return. These results suggest that infants understand deceptive intentions before their second birthday.

In contrast, 3-year-olds tend to show a bias towards trusting adults, even if they can see that testimony is false (Jaswal, 2010). For example, they trust an adult's gesture about where a ball has landed more than their own perception. Further, children consistently trust the misleading pointing gestures of a confederate when searching for a hidden sticker, even when they have experienced repeated deception by the same person in the past (Couillard & Woodward, 1999). Research suggests that until age 4.5, children seem to struggle with correctly interpreting deceptive gestures or verbal cues compared to other markers of deception. For instance, they are able to interpret deceptive information about an object's location when presented with a flattened ball or a card placed on a false location (Couillard & Woodward, 1999; G. D. Heyman et al., 2013). This suggests that children do not show a trust bias due to an inability to respond

in a way that is opposite to what has been indicated by a cue or a marker. Instead, they may have difficulties with ignoring information that they perceive as being intentionally communicated.

Recent findings suggest that experimental results generalize to an ecologically valid, real-life context. Three- to 4-year-olds can be lured away from their school grounds by a female confederate regardless of whether the information she conveys is accurate or inaccurate (Q. Li et al., 2020). However, 3-year-olds become more skeptical about a testimony when the speaker seems distracted or makes obvious naming errors (Jaswal & Malone, 2007), appearing to update their trust in an informant's claim after experiencing empirical evidence contrary to the person's previous advice (Hermansen et al., 2021). At age 4, children begin to understand intentional and epistemic aspects of deception, growing in their ability to comprehend the falsity of a statement by someone described as a liar (Mascaro & Sperber, 2009) dependent on the person's recent track record as a source of accurate or inaccurate information (Corriveau & Harris, 2009). Thus, a child's sensitivity to informational accuracy and ability to selectively trust others improves with age. Even though a 5-year-old's point of departure may include a bias towards trust, they are beginning to consider the motivations of others when evaluating the credibility of their statements. Once they have received false information, they demonstrate skepticism and mistrust, becoming more likely to rely on information provided by a cooperative- rather than a competitive partner (Stengelin et al., 2018). Further, at the age of 5, children are able to explicitly reason about the ability of another person to reliably label objects and use metacognitive strategies to evaluate their reliability in retrospect (Schütte et al., 2020).

In general, young children tend to trust others, though they are able to understand misleading hints before age 4. As they develop, children become more adept at interpreting misleading hints - both in retrospect and in real-world settings.

1.2. Children's production of lies

As elaborated in the previous section, children's vigilance towards deceptive cues emerges early in life, while a trust bias persists for many years. A question that arises is whether children's comprehension of lies and their production of lies emerge independent of each other or whether one is an ontogenetic prerequisite for the other. Researchers in the field of developmental psychology have been studying the development of dishonesty from the earliest experiments (Piaget, 1932). Using stories, Jean Piaget investigated children's moral and conceptual reasoning about lies, their consequences and motives. To date, researchers agree that deception emerges in preschool years and that children become more inclined to lie with increasing age (Chandler et al., 1989; Debey et al., 2015; Talwar & Lee, 2002a, 2002b). In the following sections, I will present research on distinct paradigms for measuring children's production of lies, ranging from early attempts to deceive to the production of antisocial- and prosocial lies. Moreover, I will point out methodological and conceptual limitations of conventional tasks. Finally, the subsections will cover research on relations between children's lies and cognitive and social correlates.

1.2.1. Early deception

Researchers have used several methods to measure different types of lies. Observational studies reveal early attempts to deceive by 2-year-old children in naturalistic settings (Newton et al., 2000). Here, mothers were instructed to use diaries to record critical behavior of their children as soon as it had happened, for a specific

period of time. In addition to observational studies, experimental paradigms have explored a wide-range of deceptive behavior. Researchers have investigated nonverbal deception in children using 'hide and seek' tasks where a child is asked to mislead another agent who is searching for a hidden object. The findings of research using this paradigm suggest that some 2- to 3-year-olds enlist the help of an adult experimenter to produce deceptive ploys and leave behind false clues in order to conceal the location of a hidden toy (Chandler et al., 1989). However, the results of subsequent research challenge these claims. When questioned, most children under age 4 struggle with selective deception and do not understand the effect their ploys have on the beliefs or behavior of others (Bigelow & Dugas, 2009; Hayashi, 2017; Mascaro et al., 2016; Sodian, 1991; Sodian et al., 1991).

Importantly, a general criticism of hide and seek tasks is that children might be successful in producing a desirable outcome without understanding the significance of their behavior in relation to the mental state of another person. These tasks might simply measure wishful thinking about where the seeker should search and do not necessarily require an understanding of mental states or the contrasting of different perspectives; both are prerequisites for lying. Further, most hide and seek tasks rely on verbal descriptions and questions, which might impede performance in young children, who are less articulate. Another important issue is that hide and seek tasks usually include explicit instructions and suggestions to lie (e.g., "When the cat comes back, we are going to play a good trick on him! We'll make him believe that the coin is in this box [pointing to the empty box]. We don't want him to believe the coin is in that box [pointing to the box containing the coin]. (…) Which box will you show the cat?") (Mascaro et al., 2016, p. 12-13). Taken together, this demonstrates that most deceptive

games and hide and seek tasks measure elicited- and suggestive-, rather than spontaneous behavior.

1.2.2. Antisocial lies

Children begin to make deliberately false statements around 2 to 3 years of age. These untrue statements are typically an attempt to conceal a rule violation, to avoid punishment, or to promote personal gain (Talwar & Lee, 2008). The temptation-resistance-paradigm has become the most common way of measuring the development of antisocial, self-serving lying (Lewis et al., 1989; Polak & Harris, 1999). In this task, children are asked not to disobey a rule (e.g., peek at a toy) in the absence of the experimenter. The findings of a range of studies suggest that most children consistently peek at the toy (for an overview, see Talwar & Crossman, 2011), and there is a positive correlation between general intelligence (IQ), emotion knowledge scores, and delay time prior to peeking. Children with higher IQ and emotion knowledge wait longer to peek (Allen & Lewis, 2020). Further, results from the same study suggest a gender effect, with girls demonstrating an ability to wait longer than boys. When asked whether they broke the rule, most 2-year-olds confess, and only a quarter lie to conceal their transgression (Evans & Lee, 2013). While younger children are less inclined to lie, about half of 3-year-olds lie about their transgression. From 4 years on, most children lie about their transgression (Talwar & Lee, 2002a).

Figure 1 depicts age-related increase in lying to conceal a transgression in the temptation-resistance paradigm (data derived from Evans & Lee, 2011; Lewis et al., 1989; A. S. Li et al., 2011; Polak & Harris, 1999; Talwar & Lee, 2002a, 2008, 2011).

Figure 1. Age-related changes in lying to conceal transgression in temptation-resistance paradigms. Reprinted and adapted with permission from "Little Liars: Development of verbal deception in children" by K. Lee, 2013, Child Development Perspectives, *7*(2), p. 92 (DOI: 10.1111/cdep.12023). Copyright 2013 by John Wiley and Sons.

In a follow-up question where an experimenter asked the children what they thought the toy was, most younger children (3-5 years) implicated themselves by accurately naming it (Talwar & Lee, 2002a). Older children (6-7 years) tended to conceal their lie by feigning ignorance or guessing the name of another toy. In preschool years, lies tend to be unsophisticated and easily detectable upon probing as children in this age group struggle with semantic leakage control, making succeeding statements inconsistent with the initial lie (Talwar & Lee, 2008). Around the age of 7 to 8 years, children become increasingly sophisticated in their ability to produce and maintain lies and to ensure that subsequent statements do not contradict an initial falsehood. They are better able to imagine not having peeked and to infer what they ought to have believed, making it more difficult for naïve adults to detect dishonesty.

Temptation-resistance paradigms provide a relatively naturalistic scenario for children to tell an antisocial lie without being sanctioned. However, one major criticism

of temptation-resistance paradigms is that they might not necessarily measure strategic lying. It is unclear if untrue statements are made with the intent to implant a false belief or whether they are a form of wordplay or regret ("No, I wish I hadn't peeked" rather than, "No, I did not peak"). Further, this type of verbal questioning might lead to yes- or no- response-biases (Fritzley & Lee, 2003). Thus, it remains a topic of debate whether these early, emergent, untrue statements truly are a rudimentary form of authentic lies. Overall, the findings suggest that the ability to lie emerges at a young age and develops rapidly within the next years. However, the ability to maintain the initial lie emerges later.

1.2.3. Prosocial lies

Infants engage in prosocial behavior and are motivated to help others from the earliest stages of life. They show instrumental helping by picking up objects or opening doors for others (Warneken & Tomasello, 2006) and informative helping by pointing to direct an adult's attention when they know an object's location (Liszkowski et al., 2006, 2008). Lying to benefit another person can also be considered a prosocial act and is present at a young age. The first published study on children's prosocial lying made use of the reverse-rouge-task (Talwar & Lee, 2002b). In this task, children were supposed to take a photo of an experimenter who had a visible red mark on his nose. Before taking the photo, the experimenter asked the child, "Do I look okay for the photo?" Most 3- to 7-year-olds in this study lied to the experimenter but admitted to a confederate that they had seen the mark. However, the paradigm has methodological shortcomings. Children might be motivated to tell a white lie due to self-interest in avoiding negative reactions from adults rather than for prosocial reasons. Subsequently, researchers developed the 'disappointing gift' paradigm (Talwar, Murphy, et al., 2007; Talwar & Lee, 2002b).

After receiving an undesirable gift, such as a bar of white soap, children were asked by the gift-giver whether they liked it. Parents were asked to verify the child's true feelings about the gift. Most children chose politeness over truthfulness. In other words, they told white lies to protect the feelings of the adult, even if the lie was contrary to their own desire. The results revealed a clear, age-related increase in prosocial lying, with most of the children participants not lying before age 4. Research further revealed an ingroup-bias for both prosocial lies and evaluations of prosocial lies (Sierksma et al., 2019). Children were more willing to tell a prosocial lie from about 11 years of age if they received a gift from an ingroup peer than if they received a gift from an outgroup peer. Further, they rated prosocial lies told for the benefit of an ingroup member more positively than prosocial lies told for the benefit of an outgroup member.

It should be noted that performance in the disappointing gift paradigm does not necessarily reflect intentional falsehood but may capture a pragmatic understanding of social norms and conventions. Moreover, it remains unclear whether these early prosocial lies are truly altruistic or if they are told to avoid getting in trouble. While most younger children (7-year-olds) justified their prosocial lying with non-prosocial reasons (e.g., to avoid angering the gift-giver), most older children (11-year-olds) justified their lying using prosocial reasons (e.g., to protect the feelings of the gift-giver) (Xu et al., 2010). Moreover, children from 7 years onwards considered another person's emotions when deciding whether or not to tell a white lie. They were more likely to tell a white lie about a person's artwork when the person had expressed sadness about her work than when she was indifferent (Warneken & Orlins, 2015). This suggests that children tell prosocial lies to make others feel better - and not only out of politeness. Children at the age of 7 also evaluate lies based on their effect on another person's

feelings (G. D. Heyman et al., 2009), and even 4-year-olds evaluate prosocial lies less negatively than antisocial lies. However, from age 8 onward, they anticipate greater self-approval for truth-telling and self-disapproval for lying (Bussey, 1999).

Besides telling white lies to adhere to social norms or to protect someone's feelings, children tell prosocial lies to conceal another person's transgression. Research suggests that children are willing to lie to conceal another person's wrongdoing when given an incentive (Talwar et al., 2004) and when the lie does not conflict with their self-interest (Pipe & Wilson, 1994). However, if there is a chance that they will be incriminated in the wrongdoing, they are less likely to lie for the sake of another.

With increasing age, children become more likely to lie to benefit their group ("blue lies"). In an experimental study, researchers instructed children to create teams consisting of two experienced and two novice players for a chess competition (Fu et al., 2008). All classes violated the rule by choosing four experienced players to maximize their probability of winning. When an experimenter privately interviewed the children about their adherence to the rule, only 7% of 7-year-olds lied about their group's cheating behavior, whereas 30% of 11-year-olds lied. This pattern was also present in results studying the moral evaluations of children: lying for the self was rated more negatively, whereas lying for the collective good was rated more positively, an effect that increased with age.

Talwar et al. (2019) conducted a longitudinal study to examine the development of children's lying across different motivational domains. In this study, children were tested at two points in time (at age 4 and 6) across two prosocial- and two antisocial lying contexts. Results revealed that children were consistent in telling antisocial and prosocial at both ages and that lying at the age of 4 was related to lying at the age of 6.

However, antisocial lying decreased with age, whereas the opposite was true for prosocial lying, suggesting that lying is not uniform across motivational contexts. These results are consistent with other research indicating that children may first tell lies for themselves and then for others (Talwar, Crossman, et al., 2017). This developmental pattern may illustrate socialization towards socially acceptable behavior (Lavoie, Yachison, et al., 2017). In line with this point, research suggests that children's reasoning about dishonesty becomes more nuanced with age (Lavoie, Nagar, et al., 2017). Young children start with the assumption that lying is never acceptable. This assumption evolves into a perspective that lying is a social behavior that can be acceptable and may be used to maintain social relationships. Moreover, it may reflect children's moral reasoning, shifting from a self-oriented focus to an other-oriented focus (Talwar et al., 2019).

1.2.4. Cognitive correlates

Lying serves as a window into many aspects of a child's developing mind and its social and cognitive abilities. Both cognitive and social factors influence the development of dishonesty. In this subsection, I will discuss the role of Theory of Mind, executive function, and the social environment (e.g., parenting style or siblings) in relation to the development of lying in young children.

1.2.4.1. Theory of Mind

Theory of Mind (ToM) is the ability to attribute mental states such as beliefs, desires, and thoughts to others (Premack & Woodruff, 1978). When lying, one intends to implant a false belief in the recipient to make him behave in a manner anticipated by the liar. Thus lying requires the ability to comprehend that another person's knowledge can be manipulated (Talwar & Crossman, 2011; Talwar & Lee, 2008). Various studies

converge to show that children begin to lie around 4 years of age, the same age when they pass the standard verbal false belief task (Talwar & Crossman, 2011). Further research has revealed a direct association between the ability to lie and ToM (Bigelow & Dugas, 2009; Evans et al., 2011; Leduc et al., 2017; Ma et al., 2015; Talwar, Gordon, et al., 2007; Williams et al., 2016). While lying has been shown to be related to first-order false belief understanding (i.e., the understanding of false beliefs with regard to real events), the ability to maintain a lie seems to be related to their second-order false belief understanding (i.e., that is the understanding of what someone else thinks about another person's beliefs) (Talwar, Gordon, et al., 2007; Talwar & Lee, 2008). Training studies have even provided evidence for a causal link between ToM and lying in both directions. On the one hand, explicit ToM training leads to deception in young children (Ding et al., 2015). On the other hand, learning how to deceive enhances ToM skills in children (Ding, Heyman, Sai, et al., 2018). Other views suggest that early deceptive behavior seems to be related to the understanding of knowledge ignorance (Leduc et al., 2017; Ma et al., 2015). This suggests that less complex ToM skills may be needed for deception. In other words, in order to deceive someone it might be sufficient to understand that this person lacks information, i.e., that this person is ignorant about something. Recent findings suggest that the understanding of mental states is related to lying in competitive games but not to lying in temptation-resistance paradigms (Sai et al., 2020). The authors suggest that concealing a transgression in temptation-resistance paradigms may be more strongly related to moral and social learning as well as negative social consequences than lying in competitive games. Thus, children may actively decide not to engage in concealing a transgression even if they are cognitively able to lie. Other findings suggest an indirect pathway between parental mental state talk and

children's lying, which is mediated by children's false belief understanding (Ding et al., 2021).

Recent meta-analytic findings suggest a small, significant positive association between ToM and lying (J. Y. S. Lee & Imuta, 2021; Sai et al., 2021). This association is moderated by the facet (understanding, production, maintenance) and valence of lying (antisocial, prosocial), the type of ToM (first-order, second-order) and by cultural setting (collectivist, individualist culture) (J. Y. S. Lee & Imuta, 2021). Taken together, it becomes evident that the cognitive correlates of children's lying, the understanding of other's minds in particular, depend on the specific form of lying.

1.2.4.2. Executive function

According to the activation-decision-construction model (Walczyk et al., 2003, 2009), executive function plays an important role in lying. The model describes lying as a series of cognitive events with the truth leading to automatic activation of working memory, followed by the intentional decision to lie and the construction of a lie. Indeed, when lying, children must hold the truth in memory, suppress sharing the truth with the other person, and at the same time, plan an alternative response to conceal the truth (Carlson et al., 1998; Talwar & Crossman, 2011). Thus, all three executive function skills (i.e., working memory, inhibitory control, and planning) are important for successful lying. Research suggests that children's lying is related to inhibitory control (Evans et al., 2011; Evans & Lee, 2013; Talwar, Crossman, et al., 2017; Talwar & Lee, 2008). There is further evidence that training children in the ability to lie improves their executive functioning (Ding, Heyman, Sai, et al., 2018). Maintaining a lie requires even more sophisticated executive functioning skills than needed for the initial lie. Findings suggest that inhibitory control and superior planning skills are related to lie

maintenance (O'Connor et al., 2020). Further evidence for the relation between executive function and lying come from functional magnetic resonance imaging (fMRI) studies, which have revealed that the prefrontal cortex and anterior cingulate cortex play critical roles in deception, as both regions are implicated in a variety of complex behaviors such as planning, decision-making, and impulse control (Karim et al., 2010). Results from a micro genetic study suggest that ToM and executive function predict the spontaneous discovery of deceptive strategies in a win-or-lose game, suggesting that both are necessary for young children to discover their ability to lie for the first time (Ding, Heyman, Fu, et al., 2018).

1.2.5. Social correlates

Dishonesty occurs primarily in social interaction with others. Thus, it seems very likely that the emergence of lying is influenced by interactions with parents, siblings, and peers (Ma et al., 2015). Indeed, research reveals a positive correlation between exposure to a harsh and physical disciplinary parental style and children's development of lying (Stouthamer-Loeber, 1986; Talwar, Lavoie, et al., 2017; Talwar & Lee, 2011). Further, maternal disciplinary methods have been shown to be related to children's positive evaluations of antisocial lies (Mojdehi et al., 2020). In addition to parenting style, a punitive school environment was related to increased dishonesty in 3-4-year-olds (Talwar & Lee, 2011). This provides evidence that children may lie more and rate lies more positively when punishment is predictable (Popliger et al., 2011; Talwar, Murphy, et al., 2007). Moreover, authoritative parenting, as well as emotional expression and talking about feelings within the family were related to children's prosocial lying (Popliger et al., 2011; Talwar, Murphy, et al., 2007). Further research indicates that children with older siblings are more likely to lie in a temptation-

resistance paradigm, independently of their ToM or executive functioning performance (Nagar et al., 2019). This suggests that having an older sibling has a direct effect on the development of antisocial lying.

On the other hand, parental warmth and authoritarian parenting (high discipline and responsiveness) seem to decrease dishonesty (Popliger et al., 2011; Stouthamer-Loeber, 1986). Further, highly authoritative parenting and high inhibitory control have been shown to be related to a reduced propensity to lie (Talwar, Lavoie, et al., 2017). Interestingly, lying children were better at semantic leakage control. The authors argue that responsive parenting behavior, which discourages dishonesty, might moderate the relation between children's lying and their cognitive abilities. Controlling parenting, characterized by high levels of monitoring and demanding, as well as authoritative parenting, diminished antisocial lying in 3-year-olds. The relation was mediated through the delay of ToM understanding (Ma et al., 2015).

Moreover, parenting behavior has been shown to moderate the relation between lies and behavioral problems (Lavoie et al., 2018). In addition, what parents teach their children about the acceptability of lies has an influence on children's dishonesty (Lavoie et al., 2016). Overall, findings are diverse and more research is needed to better understand the social correlates of lying.

1.3. Detecting lies in children

As elaborated in section 1.1, during all stages of human evolution, untrustworthy individuals were identified and excluded from the group quickly. Consequently, from an evolutionary perspective, it is not only crucial to learn to trust others selectively, but it is also essential to learn how to keep your lies from being detected by others. The ability to lie should thus come along with competencies to mask

lies, and it seems likely that both abilities emerge in close synchrony during human ontogeny. Thus, a question that emerges is how well we can discriminate truthfulness from intentionally false statements communicated by children.

When questioned in the temptation-resistance paradigm, 3-year-olds were able to mask their expressive behavior, making it impossible for adult judges to accurately discriminate between children who lied and those who spoke the truth on the basis of their facial and bodily behavior (Lewis et al., 1989). While adult evaluators could not discriminate between these children based on their nonverbal expressive behaviors, they could correctly identify most of the liars based on their verbal statements, suggesting that most children were poor at semantic leakage control until age 3 or older (Talwar & Lee, 2002a). Taken together, these results indicate that children under the age of 8 years are not fully skilled at lying. Interestingly, for children who received parental coaching to lie, their true and false reports could not be distinguished by naïve raters based on verbal markers such as cognitive processes, temporal information, or self-references (Talwar et al., 2018).

A meta-analysis including 45 experiments with 1,858 children and 7,893 adult judges examined adults' ability to detect lies in children under the age of 17 years (Gongola et al., 2017). Results revealed that adults could accurately discriminate honest statements from lies at an average rate of 54% above chance with professionals outperforming laypersons, which was similar to adults' ability to detect deception in adults. When viewing children's truthful and dishonest reports (9-11 years of age), older adults (66-89 years) had a stronger truth bias than younger adults (18-30 years) and rated children as more credible and honest (O'Connor et al., 2019). Interestingly, children can detect prosocial lying in other children from the age of 6 years (Eskritt &

Lee, 2017). Investigations on the detection of lies in children have important practical implications (e.g., when evaluating children's credibility and their competence as witnesses in courts of law).

1.4. Children's moral evaluations

As trust, commitment and fairness are key aspects for collaborative success, social and moral evaluations become important social competencies (Tomasello, 2019). In the process of partner choice, individuals evaluate the cooperativeness of potential partners and are eager to demonstrate that they are a good partner for collaboration themselves. Interestingly, the sense of self as seen through the eyes of others is a uniquely human ability. While great apes influence others directly (e.g., by demonstrating their dominance), they do not "simulate the perspective and evaluations of others for the purpose of actively managing the impression they are making on them" (Tomasello, 2019, p. 281). Social and moral evaluations are thus key mechanisms for the functioning of large-scale human cooperation and culture.

Infants engage in processes of social and moral evaluations from extremely early on. At the age of 6 months, they evaluate individuals on the basis of their behavior towards others: They prefer puppets who help others to puppets who hinder others (Hamlin et al., 2007). Their evaluations are sophisticated, flexible, and consistent with adult's moral judgments (Hamlin, 2013). At the age of 3 years, children prefer a benevolent communicator over a malevolent communicator (Mascaro & Sperber, 2009). The early emergence of children's moral evaluations supports theories on the coevolution of cooperation and morality, suggesting that morality is a core aspect of human nature. This is consistent with research with older children, who use fairness to

evaluate social partners. Around the age of 6 years, children value a fair distribution over a generous distribution to their favor (Shaw et al., 2012).

Children do not only morally judge others, but their behavior is also influenced by the knowledge that they are themselves being assessed by others. For instance, young children modify their behavior in the presence of others. Using a modified watching eyes paradigm with 3-year-olds, research revealed more prosocial behavior in the presence of eyes versus control images (Kelsey et al., 2018). This suggests that simple cues of human presence influence children's prosocial behavior. Further, at the age of 3 years, children make direct inferences about how they will be judged by others and act on behalf of these inferences. In a delay-of-gratification task, 3-year-olds wait longer if they are told that a teacher or a peer would find out how long they have waited (Ma et al., 2020). While both conditions show clear reputation effects, children wait even longer if they are told that they would be evaluated by a teacher rather than a peer. Thus, reputational concerns do not only influence children's waiting times, but they consider the identity of the potential evaluator, even if the expected evaluator is not physically present. Research with 5-year-olds further revealed that they behave more prosocially in the presence of others (Engelmann & Rapp, 2018). For instance, children are more generous in distributing a resource when the recipient is visible and fully aware of the donation option than when he is not (Leimgruber et al., 2012). They thus exhibit strategic prosociality in order to manage their reputation. Moreover, 5-year-olds are less likely to cheat if they are told that they have a positive reputation to maintain (Fu et al., 2016).

On the other hand, research suggests that with age, children become more critical of self-promoting strategies. They begin to learn that positive claims about

themselves might have benefits as well as reputational costs (Amemiya et al., 2020). In a study conducted by Amemiya et al. (2020), 6-year-olds consistently evaluate self-promotional statements positively, whereas 9-year-olds show context-sensitivity and only rate positive claims more favorably if they can be interpreted as an implicit offer to help. Recently, a study investigated conflicts between protecting another person's reputation and telling the truth (Ahn et al., 2020). Seven- to 11-year-olds rated another child, who assessed a classmate's public performance. Children rated evaluators more favorably if they falsely described the performance as good than if they had truthfully described the performance as bad. This suggests that promoting others' reputation is evaluated positively, even if it involves telling a lie.

Taken together, moral evaluations are present remarkably early in ontogeny. Even at a young age, children judge themselves as they would judge others and are concerned about being perceived as a good partner (Tomasello 2019). Consequently, they engage in strategic behavior to manage their reputation and to cooperate with others while being aware of the reputational costs and limits at the same time.

2. Rationale for the current thesis

The ability to take and influence others' perspectives is a key element that underlies collaborative success and large-scale human cooperation. When lying, one does not intend to align perspectives with others but rather intends to confront the other with a different, non-factual perspective with the goal to implant a false belief and change the other's knowledge. Cognitively, lying thus involves the understanding and representation of conflicting perspectives at the same time. Previous findings suggest that in communication with others, most children do not deliberately manipulate others' perspectives before the age of 4 years. However, as described in the previous chapters, conventional lying paradigms have several conceptual limitations and might not necessarily reflect strategic falsehood. An important methodological limitation of most paradigms is that they completely rely on verbal questions and descriptions and thus obstruct younger children from telling lies. Research has found evidence that perspective breaks and questions during the task lead to an interruption of operational processes and spontaneous behavior intentions in young children (Rubio-Fernández, 2013; Rubio-Fernández & Geurts, 2016). Prior studies have relied on paradigms that require verbal instructions and descriptions as well as explicit questions in order to evoke lying in children. They may have missed out on measuring a fully spontaneous, anticipatory understanding and manipulation of others' minds within an interactional flow.

Thus, the present thesis aimed to investigate the development of lying within interactions. It further aimed to understand its cognitive, motivational, and social foundations as well as developmental origins. In particular, this dissertation examined four main research questions. The first research question was whether children younger

than age 4 were able to lie spontaneously when tested in an interactive paradigm and when this ability first emerges. As elaborated in the previous chapter, it remains a topic of debate whether conventional lying paradigms capture intentional and spontaneous lying since they often use explicit questions or even instructions to deceive an agent. Moreover, there are reasons to believe that conventional paradigms impede lying in young children. Thus, even young children may be able to lie nonverbally in tasks with reduced processing demands, measuring lying in an interactive flow without disruptions of their perspective tracking processes.

The second research question was whether motivational, cognitive, and social factors as well as explicit skills influence spontaneous lying in the interactive paradigm. Research suggests that lying varies as a function of motivational context. Some researchers argue that children tell lies first for egocentric purposes (Talwar, Crossman, et al., 2017), and personal incentives seem to increase children's withholding of information (Bottoms et al., 2002). Thus, egocentric and prosocial motivations may influence children's spontaneous lying in interactions with others. Further, social factors such as parenting behavior have been shown to be related to children's dishonesty, and previous research has revealed correlative and causal evidence for a relation between lying, ToM, and inhibitory control. Thus, these social and cognitive skills may also be related to spontaneous lying in children younger than 4. On the other hand, young children might be able to spontaneously lie in interactions with others while lacking the skills to hypothetically plan and explicitly talk about their behavior.

The third research question was whether children make strategic decisions about when to tell a lie based on the recipient's epistemic state. More precisely, it was in question whether children adapt their lying to another person's ignorance, false belief,

or true belief about an objective situation. As was pointed out before, lying seems to require an understanding and active manipulation of others' mental states. However, lying seems to be more or less relevant depending on the other person's level of knowledge. Yet, comparatively few attempts have been made to explore whether children adapt their lying to the epistemic states of others.

The fourth and last research question was whether children lie for reputational concerns. Research suggests that even young children engage in strategic behaviors to manipulate the impressions others form of them. For instance, 3-year-old children anticipate consequences for their reputation and act accordingly. Further, they care more about their reputation with ingroup than with outgroup members (Engelmann et al., 2013). To date, it is unclear whether children spontaneously lie in order to manage their or their group's reputation and whether this is different with ingroup than with outgroup peers.

In order to answer the research questions, four independent studies were conducted. All studies were conducted in accordance with the Declaration of Helsinki (General Assembly of the World Medical Association, 2014). Data was collected between June 2018 and March 2020. Table 1 provides an overview of the four studies, the research questions and participant ages.

Table 1. Overview of empirical research

Study	Research Question	Age (years)
1	What motivational, cognitive, and social correlates underlie spontaneous lying?	3
2	When does spontaneous lying emerge?	2-3
3	Do children adapt their lying to the recipient's mental state?	4
4	When does lying for reputational concern emerge?	5

Study 1 implemented a novel interactive paradigm with 3-year old children and explored the role of motivational context, explicit skills, and social-cognitive correlates for spontaneous lying. In the paradigm, a protagonist puppet played with the child and an object, and then hid the object in one of two locations. While the protagonist puppet was temporarily absent, a competitor or a friend puppet searched for the hidden object. Children knew where the object was hidden and could hence decide to share truthful or false information with the puppets. In question was whether children spontaneously inform the friend (i.e., helping) and misinform the competitor (i.e., lying) by pointing to the true or false location of the object. We expected more lying for egocentric than for prosocial purposes. Further, we assessed children's hypothetical planning abilities and included different cognitive and social measures, such as ToM, inhibition, and parenting behavior. Results revealed that children lied for egocentric and prosocial purposes and that spontaneous lying was related to the understanding of false beliefs and hypothetical planning abilities.

Study 2 addressed the research question with regard to when the ability to lie first emerges. Using a modified version of the interactive paradigm described in Study 1, we replicated results with 3-year-olds and additionally tested children at the age of

2. Results revealed that children were able to selectively lie at the age of 3 but not at the age of 2 years.

Study 3 addressed the research question about whether children adapt their lying to the recipient's epistemic state. We tested 4-year-olds in a modified version of the interactive paradigm described in Study 1 and manipulated the competitor's mental state. We found that 4-year-olds adapted their lying to the competitor's ignorance, false belief, or true belief about the object's location and thus made strategic decisions about when to lie based on the recipient's knowledge.

Study 4 addressed the question of when lying emerges as a tool for reputation management and examined children's dishonesty in a peer context. Participants played a mini-dictator game in which they could share all, none, or any number of their (group's) stickers with another child. Subsequently, they were questioned about their donation via pre-recorded Skype calls. Results revealed that children's verbal statements exceeded the number of their donated stickers, but they did not consider group membership for managing their reputation.

In summary, this thesis contributes deeper and more comprehensive insights into children's developing understanding and spontaneous manipulation of others' mental states. This thesis should make an original contribution to the field of social cognition as it introduces a novel interactive paradigm to measure children's spontaneous lying. Further, the findings offer important insights into the development of ToM by exploring the developmental origins and motivational, social and cognitive foundations of children's lying.

3. Study 1: Three-year-olds' spontaneous lying in a novel, interaction-based paradigm and its relation to explicit skills and motivational factors

This chapter was published in a slightly different version under Heinrich, M., & Liszkowski, U. (2021). Three-year-olds' spontaneous lying in a novel interaction-based paradigm and its relations to explicit skills and motivational factors. *Journal of Experimental Child Psychology*, *207*, 105125. https://doi.org/10.1016/j.jecp.2021.105125

3.1. Introduction

3.1.1. 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 et al., 1999), enables one to flexibly adjust behaviors in the course of an interaction in order to coordinate meaningfully with each other (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 et al., 2010; Bloom & German, 2000; Poulin-Dubois et al., 2018; Wellman et al., 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 interaction. Until relatively recently, comparably less research has 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 (D. Buttelmann et al., 2009; Knudsen & Liszkowski, 2012a; Southgate et al., 2010) and 3-year-olds (Király et al., 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 et al., 2018, 2019; Poulin-Dubois et al., 2018; Priewasser et al., 2018). Crucially, on conceptual grounds, they are amenable to a leaner interpretation; infants may act in these tasks by tracking the adult's knowledge state and determining his 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.

3.1.2. 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, Murphy, et al., 2007; Talwar & Crossman, 2011; Talwar & Lee, 2002b) 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 of the children lying not before the age of 4 years. Antisocial lies seem to appear earlier than prosocial lies (Talwar, Crossman, et al., 2017; Talwar & Crossman, 2011), perhaps reflecting socialization toward socially accepted behavior (Lavoie, Yachison, et al., 2017). While 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 et al., 1989), although subsequent research revealed that once appropriately controlled and compared across ages, most children have difficulties with lying in such tasks before the age of 4 years (Bigelow & Dugas, 2009; Hayashi, 2017; Mascaro et al., 2016; Sodian, 1991; Sodian et al., 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 deficient at communicating a different perspective to the competitor. Similarly, Carlson et al. (1998) found that children below age 4 years had difficulties to deceptively point to a false location when instructed to trick an opponent. Hala and Russel (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 et al. (2018) found that 5-year-old children would circle a location on a map where they wanted a thief to search (falsely) for a target object. While 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 et al., 2015; Ding, Heyman, Fu, et al., 2018) found that 2-year-old children 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 is scaffolded by the experimenter and based on instructional feedback. It is less clear whether the trained competence in the task yields a transfer such that children would spontaneously lie to others in novel situations.

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.

3.1.3. 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 et al., 2008; Schmidt et al., 2013). Further, Hala and Russel (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) as well as prosocially for the benefit of the person to help her find something (Knudsen & Liszkowski, 2012b; Liszkowski et al., 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 et al., 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 et al., 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, 2004b). As reviewed before, one proposition is that lying in the sense of denying rule violations requires a less complex ToM, which pertains to understanding whether a person is knowledgeable or ignorant (Leduc et al., 2017; Ma et al., 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, et al., 2007; Williams et al., 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 et al., 1996; Reed et al., 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 et al., 1998; Carlson & Moses, 2001; Ding, Heyman, Sai, et al., 2018; Evans et al., 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 et al., 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 or 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, et al., 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 negative relations between spontaneous lying and positive responsible parenting.

3.2. Method

3.2.1. Participants

The sample consisted of 3-year-old Caucasian children (mean age = 42.48 months, *SD* = 3.68 months) who were recruited from the department's database (*n* =

48) of parents who had agreed to participate in child studies, and from daycare institutions (n = 34) in a metropolitan city in Germany. Respectively, participants were tested in the research lab or daycare centers, balanced across conditions. No SES measures were obtained, but the estimated level was middle to high, and parents typically had a high school diploma and/or university degree. The final sample included 82 participants (43 female), all of whom monolingual German native speakers. A total of 50 children were included in the competitor condition (25 for prosocial motivation) and 32 children in the friend condition (23 for prosocial motivation)[1]. Single trials (7) were excluded from analyses due to parent's interference or children's unwillingness to complete the task.

3.2.2. Set-up 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 x 6 x 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

[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.

within reach of the child. Up to four cameras recorded the child and experimenter during the experiment.

3.2.3. 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 author's 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 administered in randomized order thereafter in order not to bias infants' spontaneous behavior or fatigue them. 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.

3.2.3.1. Interaction paradigm.

The procedure unfolded as uninterrupted, continuous participatory play. All puppets were acted out by the same experimenter (the 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 supplements.

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 supplements). 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 children 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 (about 16s), the competitor appeared with the specific melody and looked around, slowly approaching the scene (see Figure 2). In the question phase (~ 16s), the competitor stopped, looked around, and asked himself “Hmm, where is the sticker?” In the choice phase (~ 16s), the competitor decisively (but slowly) approached the box with the sticker. Whenever the child indicated a box through attention-directing behavior like pointing or moving the relevant box closer, the competitor went into that direction and the choice phase started. Hence, duration of the phases could vary, and the question phase was skipped if the child already communicated during the anticipation phase. Only if children misinformed or hindered the competitor did the child receive the sticker at the end of each trial.

Figure 2. General set-up of the paradigm.

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 with 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.

3.2.3.2. Theory of mind.

Children completed a knowledge-ignorance task (Hofer & Aschersleben, 2007; Wellman & Liu, 2004b) 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.

3.2.3.3. Inhibitory control.

In order 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.

3.2.3.4. 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 (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.

3.2.4. 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 timeframe 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.

3.2.5. 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) x 2 (Conditions) x 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.

3.3. Results

3.3.1. Communication and physical intervention

Figure 3 presents the mean proportion of trials with the different behaviors in the competitor and friend conditions. A 3 (Behavior: informing, misinforming, or hindering) x 2 (Condition: competitor or friend) x 2 (Motivation: egocentric or prosocial) ANCOVA with age in months as 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) [.14, .44]). Further, 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 [.15, .5]). Children also hindered the competitor more often than the friend (mean difference = .32, $p = .001$). Our control comparisons further confirmed that in the friend condition children more frequently informed than misinformed (mean difference = .85, $p < .001$, 95% CI [.64, 1.1]) and hindered (mean difference = .85, $p < .001$, 95% CI [.62, 1.1]). 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).

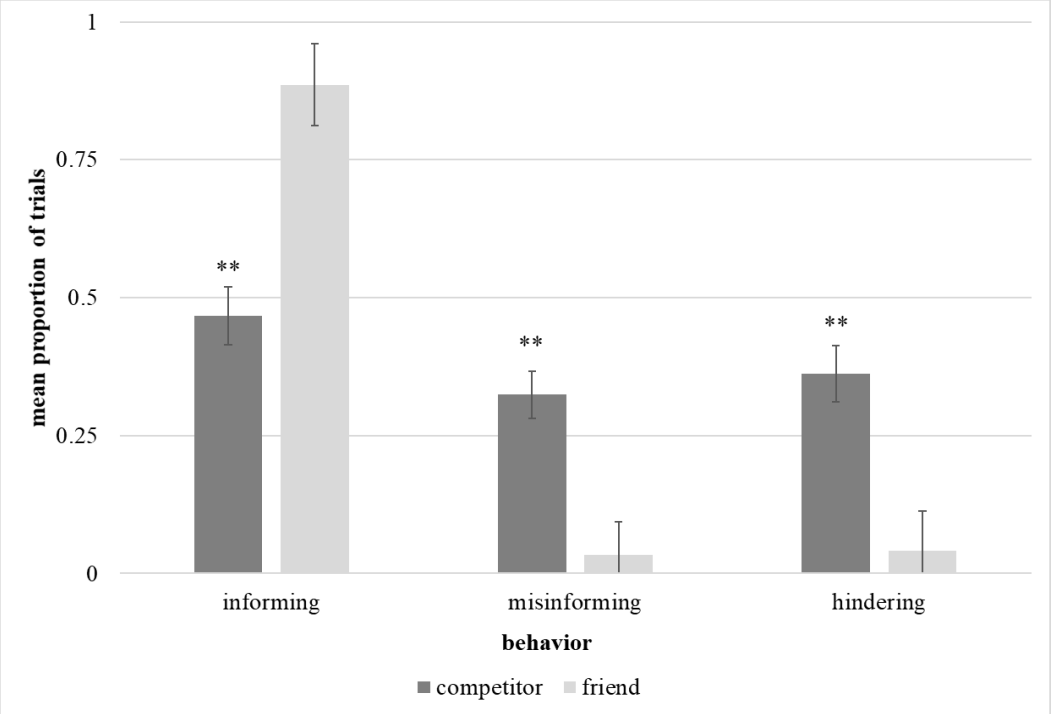

Figure 3. Mean proportion of trials with informing, misinforming and physical hindering in the competitor and friend conditions. Error bars depict standard error of the mean. ** significantly different from adjacent bar, p <. 001.

The effects of misinforming and hindering were already present in the anticipation phase (3x2 analysis of variance [ANOVA]; interaction term Condition x Behavior, $F(2, 80) = 7.81$, p = .001, η^2 = .089). Children misinformed and hindered the competitor more often than the friend (mean difference = .19, p = .001, 95% CI [.08, .31] and mean difference = .32, p = .001, 95% CI [.13, .5], respectively). A similar pattern was already present in the first trial (condition x behavior: $F(2, 80) = 3.69$, p = .027, η^2 = .044). Children misinformed and hindered the competitor more often than the friend (mean difference = .46, p = .029, 95% CI [.05, .86] and mean difference = .65,

p = .004, 95% CI [.21, 1.1], respectively). Furthermore, an analysis on the frequency of misinforming across trials with a 4 (Trial) x 2 (Condition) ANOVA revealed no changes across trials.

3.3.2. 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.

3.3.3. 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, $p = .10$).

3.3.4. 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 $p(32) < .001$].

3.3.5. 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).

3.4. Discussion

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, 2012b, 2012a). 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 mislead other persons for the benefit of a familiar interactant.

One suggestion is then 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 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.

3.5. 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.

3.6. Supplementary Material

Detailed procedure of the interaction paradigm

Competitor condition + egocentric motivation

Story introduction 1

M (Maxi): “Look, there is a sticker for you.” *Shortly shows sticker to child.*

C (Competitor, *thrilling lower-voice melody*): “Dumdidum…” *Enters scene from side.*

M (a*nxiously, concerned)*: “Who’s there? Oh no, there is bear. He wants to steal your sticker. Let’s put your sticker in this box.” *M leaves scene (under table).*

C *(nasty lower-voice):* “I know where the sticker is and I’ll grab it.” *C blackguardly takes box and leaves scene (under table).*

M returns with box.

M *(frustrated)*: “Oh no. Bear stole your sticker and you cannot paste it into your sticker book.”

Story introduction 2

M: “Look, there is another sticker for you.” *Shortly shows sticker to child.*

C (*thrilling lower-voice melody)*: “Dumdidum…” *Enters scene from side.*

M *(frustrated):* “Bear is coming again. (W*hispering*) Ssh, look what I do now. I put the sticker into this box….[*M pretends to insert sticker into box*]; but look (*gleefully*), I take the sticker with me.”*M leaves scene (under table).*

C (*nasty lower-voice*): “I know where the sticker is and I’ll grab it.” *C blackguardly takes box and leaves scene (under table).*

M returns with box.

M *(happy, relieved)*: “I tricked the bear. Now, you can paste your sticker into your sticker book.”

Test trials

M: “Look, there is another sticker for you (*shortly shows sticker to child*). I will be gone for a while. You can paste your sticker into your book as soon as I’ll be back. I put your sticker in this box so that bear does not steal it. Should the bear find the sticker? (…) No, he should not find the sticker. [*Future hypothetical question in two of four trials:* “If the bear appears, what will you do?”]. Okay. I’ll be right back.” *M leaves scene (under table).*

C (*thrilling lower-voice melody*): “Dumdidum… *[Enters scene from side.]* I want to steal the sticker (…) Where is the sticker? (*Nasty lower-voice)* I’ll grab it. (…) I am going to take this box.” *If hindered or misinformed by the child, C leaves scene with empty box; otherwise with full box.*

M returns with box.

M *(frustrated, concernced)*: “Oh no, bear stole your sticker. You cannot paste it into your sticker book.” OR *(happy, relieved)*: “Oh look, bear did not find your sticker. You can paste it into your sticker book.”

Competitor condition + prosocial motivation

(all wording and procedure is the same as before except for the indicated lines below)

Story introduction 1

M (Maxi): “Look, there is a sticker for myself.”…

M (*anxiously, concerned*): “Who’s there? Oh no, there is bear. He wants to steal my sticker. Let’s put my sticker in this box.” …

M *(frustrated)*: “Oh no. Bear stole my sticker and I cannot paste it into my sticker book.”

Story introduction 2

M: “Look, there is another sticker for myself.”…

M *(happy, relieved)*: “I tricked the bear. Now, I can paste my sticker into my sticker book.”

Test trials

M: “Look, there is another sticker for myself. (*Shortly shows sticker to child*). I will be gone for a while. I am going to paste my sticker into my book as soon as I’ll be back. I put my sticker in this box so that bear does not steal it…”…

M *(frustrated, concerned):* “Oh no, bear stole my sticker. I cannot paste it into my sticker book. OR:(*happy, relieved*) Oh look, bear did not find my sticker. I can paste it into my sticker book.”

Friend condition + egocentric motivation

Story introduction 1

M (Maxi): “Look, there is a sticker that frog can give to you.” *Shortly shows sticker to child.*

F (Friend, *friendly clear-voice melody*): “Lalila...” *Enters scene from side.*

M (*welcoming, joyfully*): “Who’s there? Oh look, there is frog. He wants to find your sticker. Let’s put the sticker in this box.” *M leaves scene (under table).*

F (*friendly, warm voice*): “I know where the sticker is and I’ll give it to you.” *F takes box and leaves scene (under table). F returns with sticker, gives sticker to the child and leaves scene (under table).*

M returns with box.

M *(happy)*: “Great. Frog found your sticker and you can paste it into your sticker book.”

Story introduction 2

M: “Look, there is another sticker that frog can give to you.” *Shortly shows sticker to child.*

F (*friendly clear-voice melody)*: “Lalila...” *Enters scene from side.*

M (*welcoming, joyfully)*: “Frog is coming again. Look what I do now. I put the sticker into this box… *[sticker falls accidentally behind box without M noticing]*.” *M leaves scene (under table).*

F (*friendly, warm voice*): “I know where the sticker is and I’ll give it to you.” *F takes box and leaves scene (under table).*

M returns with box

M *(frustrated, concerned)*: “Oh no, the sticker fell next to the box. (S*ad voice*) What a pity. Now, frog could not give it to you and you could not paste your sticker into your sticker book.” *M removes sticker.*

Test trials

M: “Look, there is another sticker that frog can give to you (s*hortly shows sticker to child*). I will be gone for a while. Frog wants to find your sticker. I put your sticker into this box so that frog can give it to you. Should the frog find the sticker? (…) Yes, he should find the sticker. [*Future hypothetical question in two of four trials: “*If the frog appears, what will you do?”] Okay. I’ll be right back.” *M leaves scene (under table).*

F (*friendly clear-voice melody)*: "Lalila... *[Enters scene from side.]* I want to get the sticker (…). Where is the sticker? (*Warm, friendly voice*) I want to find it (…). I am going to take this box." *If informed by the child, F leaves scene with full box, returns with sticker for the child; and leaves scene; otherwise F leaves scene with empty box. M returns with box.*

M *(frustrated, concerned)*: "Oh no, frog did not find your sticker. (*Sad voice*) He could not give it to you and you could not paste it into your sticker book" *[M removes sticker]*. OR (*happy*): "Oh look, frog found your sticker. He could give it to you and you could paste it into your sticker book."

Friend condition + prosocial motivation

(all wording and procedure is the same as before except for the indicated lines below)

Story introduction 1

M: "Look, there is a sticker for frog."…

M (*welcoming, joyfully)*: "Who's there? Oh look, there is frog. He wants to find his sticker. Let's put the sticker in this box."…

M (*happy*): "Great. Frog found the sticker and could paste it into his sticker book."

Story introduction 2

M: "Look, there is another sticker for frog."…

M (*frustrated, concerned*): "Oh no, the sticker fell next to the box. (*Sad voice*) What a pity. Now, frog cannot paste his sticker into his sticker book."…

Test trials

M: “Look, there is another sticker for frog. *Shortly shows sticker to child*. I will be gone for a while. Frog wants to paste his sticker into his book. I put his sticker into this box so that frog can get it…” …

M *(frustrated, concerned)*: “Oh no, frog did not find his sticker. He could not paste it into his sticker book” *[M removes sticker]*. OR (*happy*): “Oh look, frog found his sticker. He could paste it into his sticker book.”

4. Study 2: Three- but not 2-year-olds spontaneously lie in an interaction-based task

4.1. Introduction

One-year-olds communicate meaningfully by predicting others' behavior and helpfully modifying it when appropriate. For example, they spontaneously inform an adult to help him find objects he is looking for (Liszkowski et al., 2006, 2008) or he is trying to avoid (Knudsen & Liszkowski, 2013), and they inform selectively when it is relevant to both the recipient's intentions and epistemic states, even in anticipation of his behavior (Knudsen & Liszkowski, 2012b, 2012a). However, compared to a sizable body of research on how infants spontaneously inform others in interactions, much less is known about when children begin to spontaneously *misinform* others in comparable interactive scenarios.

Cognitively, traditional accounts have suggested that children under 4 years of age have difficulties to provide non-factual, false information, that is to lie, because they do not have a full understanding of the mind (Bigelow & Dugas, 2009; Sodian, 1991). They do not represent their own perspective and someone else's different, conflicting perspective at the same time, that is they do not fully understand false beliefs (Perner, 1991; Tomasello, 2018). One problem, however, is that false belief understanding has traditionally been assessed with explicit paradigms, which rely on verbal premises and questions, and elicited typically verbal choice responses. These kinds of explicit paradigms have been criticized to carry too many task-external demands to reveal competencies in younger children (Baillargeon et al., 2010) and to disrupt the natural flow of tracking perspectives in interaction (Rubio-Fernández, 2013).

Indeed, subsequent research has suggested that in appropriate spontaneous interaction-based situations, even infants as young as 18 months use an implicit non-verbal false belief understanding, to help or inform an adult who holds a false belief (D. Buttelmann et al., 2009, 2014; F. Buttelmann et al., 2015; Carpenter et al., 2002; Knudsen & Liszkowski, 2012b; Southgate et al., 2010). The reproducibility of these findings has been questioned recently (Dörrenberg et al., 2018; Wenzel, Dörrenberg et al., 2020; Priewasser et al., 2018; but see commentaries by Baillargeon et al., 2018; and responses to commentaries by Poulin-Dubois et al., 2018). However, if infants indeed do understand others' false beliefs (Baillargeon et al., 2010), then given the ease at which infants spontaneously inform to intervene and change anticipated actions of a recipient, it would seem well plausible that toddlers are also able to spontaneously misinform, that is to lie, when the context is appropriately suited and interactive.

Initial research on toddlers' lying had suggested some early competence around age 2 (Chandler et al., 1989), but in those paradigms young children needed a lot of prompts and cues to understand the vignettes and react accordingly, making it less plausible that they were intending to lie in the proper sense of making someone falsely believe something. Other paradigms have revealed nascent competencies around age 3 (Talwar & Lee, 2008), but these paradigms rather measure concealment of information than provision of conflicting perspectives, as when conforming to norms of politeness and conduct (gloss: 'did you steal the chocolate? – No!' and 'do you like the present? – Yes!'). In those cases, the liar's goal is essentially to align perspectives, which does not necessarily require holding in mind two conflicting perspectives. In contrast, the act of lying in the sense of deliberate misinforming to protect one's own goal from a competitor's entails representing two conflicting perspectives at the same time. The

very reason to lie is borne from representing one's own perspective and in pursuit of it then confront a competitor with a different perspective. Research along these lines established in more controlled paradigms that explicit lying emerges around age 4, in parallel to passing the explicit verbal false belief task (Bigelow & Dugas, 2009; Carlson et al., 1998; Sodian, 1991; Talwar & Lee, 2008). These latter paradigms, however, have again relied on verbal vignettes, elicited responses (typically verbal), explicit instructions or explanations, which all appear less suited to assess spontaneous misinforming in children younger than 4 years of age.

Recently, Heinrich and Liszkowski (2021) developed a novel spontaneous lying paradigm similar in structure to the spontaneous informative pointing paradigms by Liszkowski and colleagues (Knudsen & Liszkowski, 2012a) and implemented the logic of previous explicit lying paradigms (Bigelow & Dugas, 2009; Sodian, 1991). Three-year-old children participated actively in a puppet play, in which a friend/ robber wanted to find/ steal a toy, which was hidden in one of two boxes. About half of the 3-year-olds spontaneously misinformed the robber with anticipatory misleading pointing gestures, more often than they did in the control condition with the friend. Interestingly, when explicitly asked, the majority of children had difficulties to explicitly state to belie the competitor, even when they spontaneously lied with misleading pointing gestures. These findings thus suggest that spontaneous lying within interaction emerges before prompted explicit verbal lying and may well be within the scope of younger children. Another finding of the study, however, was a positive correlation between 3-year-olds' spontaneous lying and their passing of a standard false belief task. That finding indicates a relation between spontaneous and explicit Theory of Mind (ToM). While the later finding could support the notion that an explicit ToM is required for lying, the

synchronic correlation does not reveal a developmental directionality. Indeed, an alternative could be that spontaneous lying rests on some form of implicit, non-verbal ToM and shows earlier in development in appropriate interactional paradigms.

In the current study we investigated whether younger children who typically do not pass the explicit false belief task spontaneously lie in an interactive paradigm. We slightly adapted the interactive paradigm by Heinrich & Liszkowski (2021) to make it suitable for 2-year-olds. We tested children on six (instead of four) test trials, and dropped any explicit questions, to increase test power and avoid confusion. We ran the modified paradigm first with 3-year-olds, aiming to reproduce the spontaneous lying effect. Introductory trials familiarized children with interacting with animated puppet characters. The paradigm made use of puppets since children may be more inclined to lie to a puppet than to an adult experimenter (Hala & Russell, 2001). The puppet's goal either aligned or conflicted with the children's goals. Children also witnessed the puppet's successful and unsuccessful achievement of his goal. In the friend condition, children could then inform a friend puppet to help find a toy in one of two boxes, so the friend could clean it and the infant and protagonist puppet could later play with it. In the competitor condition, children could then misinform a competitor puppet to hinder him from stealing a hidden toy from one of two boxes, so the infant and protagonist puppet could later play with it. The key developmental question of the current study was whether 2-year-olds would spontaneously mislead the competitor more often than the friend by pointing to the wrong box.

If 3-year-olds would spontaneously lie, it would reproduce previous findings by Heinrich & Liszkowski (2021). If younger 2-year-old children were also able to spontaneously lie, this would provide strong support for an interpretation of early false

belief understanding (Leslie, 1994; Scott & Baillargeon, 2017). Importantly, it would extend previous findings on early implicit false belief understanding in conceptual ways, as the current type of communicative lying would entail both representing one's own perspective and a confronting perspective (Heinrich & Liszkowski, 2021). It would suggest that young children flexibly use a ToM in behaviors ranging from helping and providing missing information to spontaneous lying and manipulating others' mental states before, and thus independent of verbal explicit ToM skills. On the other hand, if only older but not younger children would spontaneously lie in the current interactive paradigm, it would cast doubts about the interpretation of previous infant findings in terms of contrasting false belief understanding and instead suggest developmental change relevant to representing conflicting perspectives, either in competence or in performance.

4.2. Experiment 1

Experiment 1 aimed at reproducing the spontaneous lying effect of the previous study (Heinrich & Liszkowski, 2021) using a mildly modified version of the original paradigm, which was more suitable to test 2-year-olds (see Experiment 2). Analogous to interactive helping tasks, the paradigm had reduced processing demands and aimed at minimizing disruptions of the perspective-management process (Rubio-Fernández & Geurts, 2013). After having been familiarized with the puppets and actively participating with the protagonist puppet in the play, children and the protagonist puppet hid a toy in one of two locations. Another puppet (friend or competitor) then approached the scene. Before it was obvious from her behavior where she would look for the toy, the child could helpfully share her information or misleadingly provide false information by pointing to one of the two locations.

We expected to replicate previous findings by Heinrich & Liszkowski (2021). Accordingly, children should helpfully inform the benevolent friend more often than the competitor and they should misinform the competitor more often than the friend. We expected them to communicate to the puppet in anticipation of her behavior, before the puppet would directly address them and ask about the toy's location. Further, we expected that children should physically hinder the competitor more often than the friend. We also explored whether older 3-year-olds would perform better than younger 3-year-olds. In this age range, children pass the watershed from performing below chance to group-level chance in the standard false belief task, suggesting cognitive change.

4.2.1. Material and methods

4.2.1.1. Participants.

Participants were 33 3-year-old children (age range 37 to 48 months, mean age = 41.87 months, *SD* = 3.21) who were recruited and tested in their daycare centers. The competitor condition included 18 children (8 girls) and the friend condition 15 children (5 girls). For two children, single trials (2) were excluded from analyses due to temporary high distraction.

4.2.1.2. Set-up and Procedure.

The study was conducted in accordance with the Declaration of Helsinki. The general procedure was approved by the institutional ethics committee. Parents gave informed consent before the experiment. During the experiment, the child sat at a table opposite the experimenter. Two identical boxes (10 x 6 x 7 cm) were placed equidistant on the table between the child and the experimenter with a distance of 30 cm between the boxes and within reach of the child. As in the original study, we used three different

puppets, the protagonist puppet Maxi, the friend puppet (frog) and the competitor puppet (bear). The puppets were of equal size and cuteness and piloting had revealed no systematic differences in attraction or preference for the puppets. All puppets were acted out by the same experimenter. We further used a set of nine different attractive toys in a fixed order.

Children were randomly assigned to one of two conditions: competitor condition or friend condition. In both conditions, the interactive paradigm started with three introductory trials familiarizing the child with the puppets and the general narrative. In the introductory trials, children were shown both possible outcomes (puppets find toy vs. puppets do not find toy) and their consequences. The introductory trials were followed by six test trials testing whether children would spontaneously intervene in the story.

Competitor condition.

In the first introductory trial, Maxi brought out a new toy and shortly played with the toy together with child. Then, the competitor puppet appeared. Maxi expressed concern about the competitor puppet ("Oh, no, there is the bear…") and in order to hide the toy, put it in one of the boxes. The competitor was watching the hiding process from the edge of the table where he had appeared. Maxi then excused himself and briefly left. In his absence, the competitor went for the box with the toy, took it and left. Maxi returned with the empty box, which he had found on his way back to the table, expressed frustration and showed it to the child ("Oh no. The bear stole our toy and destroyed it, so we cannot play with it anymore."). In the second introductory trial, the procedure was the same as in the first introductory trial except that upon appearance of the competitor, Maxi asked the child to help hide the toy in one of the boxes. This was

intended to encourage the child to actively engage in the puppet play. The competitor then stole the box as before and Maxi reappeared with the empty box as before. The procedure of the third introductory trial was the same as in the first introductory trial, except that this time Maxi tricked the competitor by only pretending to insert the toy in one of the boxes, acting knowingly and deceitfully toward the child ("shh…look…"), and really took the toy with him. Consequently, the competitor went for the empty box, took it and left. When Maxi returned, he expressed joy and triumphed that he still had the toy, and that they had tricked the competitor and could now play with the toy again. Six test-trials followed, in which Maxi inserted the toy in one box (locations alternated) *before* the competitor appeared. He asked the child to take care of the toy in his absence and left. Then, the competitor appeared. Three phases of approach ensued (Knudsen & Liszkowski, 2012a). First, as displayed in Figure 4, the competitor appeared and looked around, slowly approaching the scene (anticipation phase; ~ 16s). Next, the competitor stopped and asked "Where is the toy?" (question phase; ~ 16s). Finally, the competitor decisively (but slowly) approached the full box (choice phase; ~ 16s). Whenever the child indicated a box through attention-directing behavior like pointing or moving the relevant box closer, the competitor went into that direction and the choice phase started. If the child physically hindered the competitor from approaching one of the boxes, the competitor went in the direction of the other box. Hence, duration of the phases could vary and the question phase was skipped, if the child already showed attention directing behavior during anticipation. Only if the child hindered the competitor from finding the toy (e.g., by lying or physically hindering), Maxi and the child played with the toy again at the end of each trial.

Figure 4. Child deceiving the competitor by pointing to the wrong box.

Friend condition

The friend condition was closely matched to the competitor condition. As in the competitor condition, in the first introductory trial, Maxi brought out a new toy and shortly played with the toy together with child. Then, the friend puppet appeared. Maxi expressed joy about the friend puppet ("Oh, look, there is the frog. He wants to clean the toy…") and in order to provide the toy for the friend, he put the toy in one of the boxes. The friend was watching the process from the edge of the table where he had appeared. Maxi then excused himself and briefly left. In his absence, the friend went for the box with the toy, took it and left. Maxi returned with the box, which still had the toy in it, expressed joy and showed it to the child ("Oh look. The frog has found the toy and cleaned it."). Maxi told the child that the frog loved to clean their toy and that they could play with it again. In the second introductory trial, the procedure was the same as in the first introductory trial except that upon appearance of the friend, Maxi asked the child to help put the toy in one of the boxes. As analogue to the competitor condition,

this was intended to encourage the child to actively engage in the puppet play. The friend then took the box as before and Maxi reappeared with the box, which still had the toy in it as before. The procedure of the third introductory trial was the same as in the first introductory trial, except that this time Maxi accidentally dropped the toy behind the box without noticing, to match the competitor condition. Consequently, the friend took the empty box, not seeing the toy behind it. Accordingly, when he returned, Maxi expressed sadness and frustration, and was sorry ("What a pity….") that the friend had not cleaned their toy. He removed the toy and told the child that they could not play with it anymore.

The ensuing six test-trials were identical to the competitor condition. If the child did not show attention-directing behavior, the friend approached the empty box. Only if the child helped the friend (e.g., by informing), Maxi and the child played with the toy again at the end of each trial.

4.2.1.3. Coding and Reliability.

Our main response measures were communicative gestures directed to the puppets, and physical actions directed at the boxes or puppets. For communicative gestures we differentiated between informing gestures (e.g., pointing to, showing, or offering the full box), enabling the puppet to find the toy, and misinforming gestures (e.g., pointing to the empty box or showing or offering the empty box) leading the puppet to take the empty box. We further coded verbal lies, if they accompanied misinforming gestures (e.g., "the sticker is in this box"). Physical actions were coded when children hindered the puppet to achieve her goal through physical object-directed actions, e.g., by blocking access to the full box; holding-up the puppet; hiding the full

box behind the rater who was naïve to the hypotheses recoded 25% of the videos for interrater-reliability. Interrater-reliability was excellent with Cohen's κ =.94.

4.2.1.4. Analytic strategy.

To answer our main research question whether 3-year-olds would lie and physically hinder the competitor but inform the friend, we analyzed the mean proportion of trials with informing, misinforming, and physically hindering between conditions. To test whether children communicated before the puppet would approach one of the boxes (choice phase), we ran these analyses on behaviors in the anticipation and question phase only. To check for learning effects across repeated trials, we analyzed performance across trials. We further analyzed behaviors on the individual level. To explore age effects, we computed correlations between age in months and the dependent behaviors, and compared 3 - 3.5- with 3.5 - 4-year-olds.

4.2.2. Results

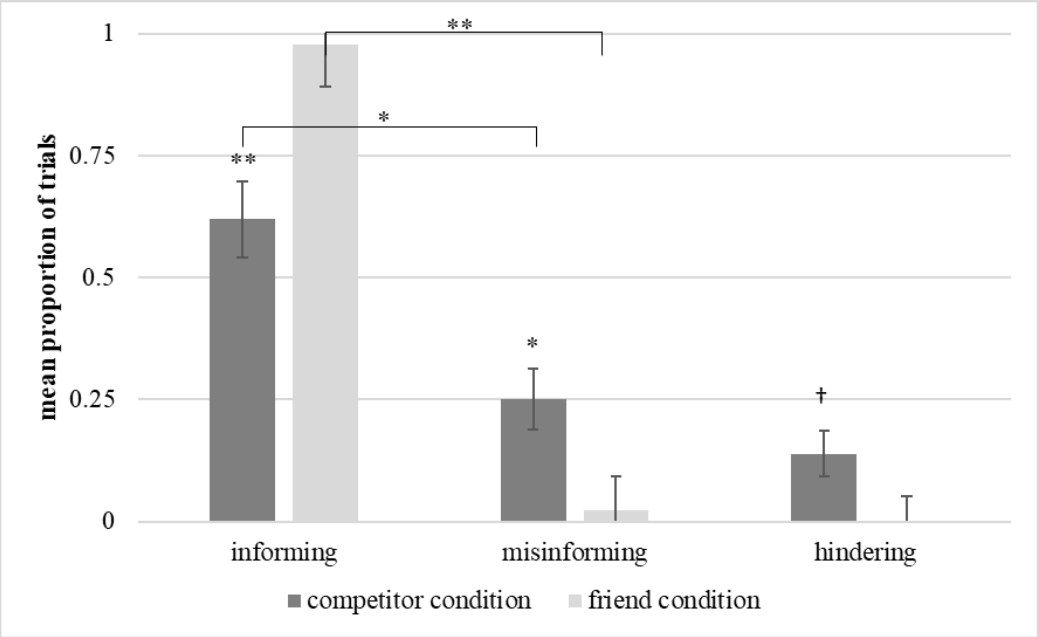

Figure 5. Mean proportion of trials with informing, misinforming and hindering in the competitor and the friend condition. Bars indicate standard errors of the mean. Stars indicate a significant difference from adjacent or indicated bar, † $p < .1$, * $p < .05$, ** $p < .001$.

Figure 5 displays children's mean proportion of trials with the different behaviors in the two conditions. A 3 (Behavior) x 2 (Condition) analysis of variance (ANOVA) revealed a significant main effect of behavior, $F(1, 31) = 50.45$, $p < .001$, $\eta^2 = .62$, and an interaction between behavior and condition, $F(1, 31) = 7.73$, $p = .003$, $\eta^2 = .2$. Following our predictions, comparisons of means confirmed that children misinformed the competitor more often than the friend, mean difference = .23, $p = .021$). Children also tended to physically hindered the competitor more often than the friend, mean difference = .14, $p = .03$, one-tailed. As expected, children informed the friend more often than the competitor, mean difference = .36, $p = .004$. In both conditions, children more frequently informed than misinformed the puppets (competitor condition: mean difference = .37, $p = .008$ and friend condition: mean difference = 1, $p < .001$). A 6 (Trial) x 2 (Condition) ANOVA on children's misinforming gestures revealed no changes over trials.

A 3 (Behavior) x 2 (Condition) ANOVA for behavior in the anticipation and question phases confirmed the general pattern of the main analyses and revealed a main effect of behavior, $F(2, 31) = 52.99$, $p < .001$, $\eta^2 = .63$, and a significant interaction with condition, $F(2, 31) = 7.94$, $p = .001$, $\eta^2 = .2$. Thus, before it was clear from her behavior which box the puppet would approach, children misinformed and physically hindered the competitor more often than the friend (misinforming: mean difference = .23, $p = .021$ and hindering: mean difference = .13, $p = .045$). Further, they informed the friend more often than the competitor, mean difference = .36, $p = .004$. Again, in both conditions, children more frequently informed than misinformed the puppets (competitor condition: mean difference = .37, $p = .008$ and friend condition: mean difference = .96, $p < .001$).

The majority of children (89%) informed the friend (binomial test, two-tailed, $p = .007$, n = 15), whereas only 39% informed the competitor (binomial test, two-tailed, $p = .48$, n = 18). Children thus informed the competitor significantly less often than the friend, Fisher's exact test, $p = .011$. In the competitor condition, eight of 18 children (44%) misinformed at least once, whereas in the friend condition only two children (13%) misinformed at least once, presumably accidentally, Fisher's exact test, $p=.035$, one-tailed. Three out of eight children in the competitor condition added verbal lies to their misinforming pointing gestures (e.g. "the toy is in this box"). Six children physically hindered the competitor from getting the toy at least once (33%) by pushing the competitor away or by hiding the full box behind the back, but no child physically hindered the friend from finding the toy, Fisher's exact test, $p = .021$.

Exploratory analyses of age effects revealed that in the competitor condition, informing gestures decreased with age in months, $r(17) = -.67$, $p = .003$, suggesting that children became better at withholding true information for the competitor. Misinforming did not correlate continuously with age, but the group comparison between younger and older 3-year-olds indicated that older children (3.5 - 4 years of age, $n = 11$) misinformed the competitor more often than younger children (3 - 3.5 years of age, $n = 6$), $t(13$, adjusted for unequal variances$) = 2.44$, $p = .029$, suggesting that children became better at providing false information for the competitor. Physically hindering did not reveal any age effects.

4.2.3. Discussion

Experiment 1 reproduced main findings of a previous study (Heinrich & Liszkowski, 2021). In the interaction-based lying paradigm, 3-year-olds spontaneously provided false information in anticipation of misleading a recipient to prevent him from

reaching his goal. Children provided true or false information selectively for the friend and competitor, which demonstrates that children did not point erroneously to an empty box. Instead, they intentionally choose to misinform the competitor. Children's intention to prevent the competitor from reaching his goal was further apparent in their selective physical hindering of the competitor. Only a few children added verbal lies to their gestures, revealing that children intentionally provide false information before they are able to lie verbally.

Despite their spontaneous misinforming, children more often informed than misinformed the competitor. This may reflect a default bias to communicate truthfully (Carlson et al., 1998; Jaswal, 2010). Nevertheless, significantly less children truthfully informed in the competitor compared to the friend condition, revealing some level of intentional control over the bias. The age effects suggest that children become better at withholding the bias of truthful informing in the second half of their fourth year of life. At the same time, they seem to become more proficient at misinforming. The developmental key question is, whether children younger than 3 years of age demonstrate similar skills of misinforming. We pursued this main question in Experiment 2.

4.3. Experiment 2

Experiment 2 used the same interactive lying paradigm to examine whether also 2-year-olds provide information for others selectively, and whether they are able to lie spontaneously when tested in social interactions with others. If 2-year-olds had an early false-belief understanding including the ability to manage conflicting perspectives, they should helpfully inform the benevolent friend more often than the competitor, and they should misinform the competitor more often than the friend. They should communicate

to the puppets spontaneously and in anticipation of their behaviors. If 2-year-olds were able to predict the puppets' behaviors but had difficulties with providing false perspectives, they could also physically hinder rather than lie to the competitor puppet.

4.3.1. Method

4.3.1.1. Participants.

Participants were 42 2-year-olds (age range 24 to 35 months, mean age = 30.19 months, *SD* = 3.17) who were recruited from the department's database and tested in the research lab. Twenty-one children were tested in the competitor condition (10 girls) and 21 children were tested in the friend condition (12 girls). For 14 children single trials (28) were excluded due to fussiness or temporary distraction.

4.3.1.2. Procedure.

The set-up, materials and procedure were the same as in Experiment 1, except that the child sat on the parent's lap during the testing. Parents were instructed not to interfere or interact with the child during the testing.

4.3.1.3. Coding and Reliability.

Coding was the same as in Experiment 1. Interrater-reliability was excellent with Cohen's κ =.86.

4.3.1.4. Analytic strategy.

Our plan of analyses was the same as in Experiment 1.

4.3.2. Results

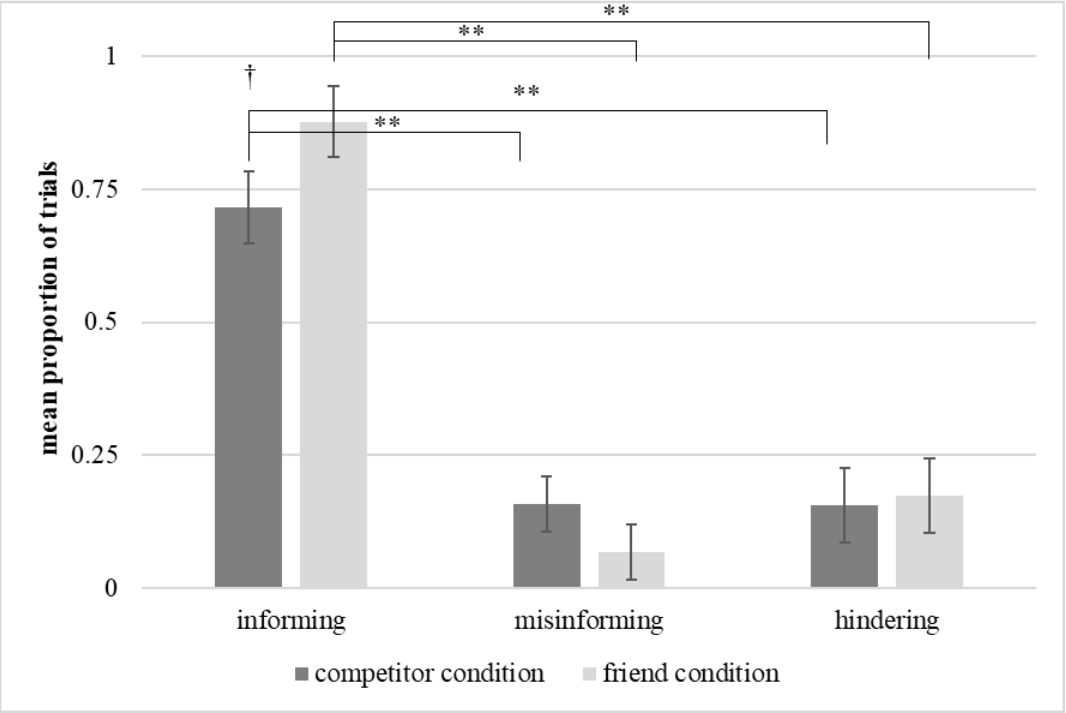

Figure 6. Mean proportion of trials with informing and misinforming gestures in the competitor and the friend condition. Bars indicate standard errors of the mean. Stars indicate a significant difference from adjacent or indicated bar, †$p < .1$, **$p < .001$.

A 3 (Behavior) x 2 (Condition) ANOVA revealed a significant main effect of behavior, $F(2, 40) = 60.31$, $p < .001$, $\eta^2 = .6$ but no significant interaction, $F(2, 40) = 1.67$, $p = .11$, $\eta^2 = .04$. In both conditions children more frequently informed than misinformed the puppets, by pointing to the full box (friend condition: mean difference = .8, $p < .001$ and competitor condition: mean difference = .56, $p < .001$), and they more frequently informed than physically hindered both puppets (friend condition: mean difference = .7, $p < .001$ and competitor condition: mean difference = .56, $p < .001$). This suggests that misinforming, physically hindering or withholding the information were no prevalent strategies to prevent the competitor from stealing the toy. When directly testing our hypotheses, there was only weak marginal support that children

informed the friend more often than the competitor, mean difference = .16, p = .05, one-tailed, and children did not misinform or physically hinder the competitor more often than the friend, misinforming: mean difference = .091, p = .225; hindering: mean difference = .019, p = .85.

The general pattern of findings held when analyzing the anticipation phase before the puppet's choice (main effect of behavior: $F(2, 40) = 76.4$, $p < .001$, $\eta^2 = .66$). Children more frequently informed than misinformed or physically hindered the puppets (misinforming: mean difference = .69, $p < .001$ and hindering: mean difference = .69, $p < .001$) with no differences between conditions.

The majority of children (95%) informed the friend, e.g. by pointing to the full box, binomial test, two-tailed, $p < .001$, $n = 21$. The majority of children (86%) also informed the competitor, binomial test, two-tailed, $p = .001$, $n = 21$, with no significant difference between conditions, Fisher's exact test $p > .05$.

Only six children (29%) misinformed in the competitor condition at least once (below chance, binomial test, one-tailed, $p = .039$ $n = 21$), e.g., by pointing to the empty box; however, four children (19%) also misinformed the friend (below chance, binomial test, two-tailed, $p = .007$, $n = 21$), yielding no significant differences between conditions (Fisher's exact test, $p > .05$). No child told a verbal lie. Only five children (24%) physically hindered the competitor (below chance; binomial test, two-tailed, $p = .027$, $n = 21$); however six children (29%) also physically hindered the friend, Fishers exact test, $p > .05$.

In the competitor condition, there was no correlation between age and misinforming gestures, informing gestures, or physical hindering, nor a difference between older and younger 2-year-olds. In the friend condition, informing gestures

increased with age, $r(21) = .47$, $p = .031$, and misinforming gestures decreased with age, $r(21) = -.52$, $p = .016$. Physically hindering did not correlate with age.

4.3.3. Discussion

Experiment 2 investigated 2-year-old's ability to understand and manipulate others' mental states in an interaction-based lying paradigm. Findings reveal that most children shared their information with both, the friend and the competitor puppet. Children provided information spontaneously and in anticipation of the puppets' goals. Only a few children misinformed the competitor. Physically hindering or withholding the information to prevent the competitor from stealing the toy were not popular strategies either. This suggests that by 2 years of age, children do not lie spontaneously and selectively. There was a weak tendency for more informing in the friend than in the competitor condition, suggesting that children shared their information more readily with the friend than with the competitor. With age, children became more precise in informing the friend more and misinforming him less, that is, they became more accurate at communicating; however, they did not communicate a contrasting perspective by implanting a false belief.

4.4. General Discussion

Conventional lying paradigms, measuring elicited, reflective and often verbal responses outside of direct interactions, might have underestimated children's early capacity to understand and manipulate the mental states of others. In order to capture 2- and 3-year old's spontaneous manipulation of other's minds and thus early ToM competencies within social interactions, the present study used an interactive lying paradigm by Heinrich & Liszkowski (2021), analogous to existing informing paradigms (Liszkowski et al., 2008) in a slightly modified version. Results revealed

that children of both age groups readily engaged in the puppet play and provided missing information for the friend puppet in order to help him find a hidden toy, e.g., by pointing to the full box. This indicates that the modified paradigm was suitable to test young children and confirms previous findings on spontaneous communication in infancy studies (Liszkowski et al., 2006). Furthermore, we found that 3-year-olds spontaneously provided false information for the competitor to prevent him from finding the hidden object, e.g., by pointing to the empty box. This replicates recent findings (Heinrich & Liszkowski, 2021) and supports the interpretation that 3-year-olds have the skills for providing a contrasting perspective while maintaining their own perspective. The current study, however, revealed a developmental pattern of these skills. First, Experiment 1 revealed a developmental difference in 3-year-olds with misinforming communication increasing from 3.5 to 4 years of age. Second, Experiment 2 revealed that in contrast to 3-year-olds, 2-year-olds did not provide false information to the competitor puppet.

The absence of misinforming communication at 2 years of age appears meaningful as all children readily engaged in the task. More importantly, children's competence in the same task at the age of 3 years suggests that the paradigm was generally suitable to detect the ability of spontaneous lying in young children. Results of the current study thus suggest that 2-year-olds do not have the skills to provide false perspectives for others and cast doubts about the interpretation of infant findings in terms of contrasting false belief understanding (Tomasello, 2018). The current findings instead imply a developmental change between 2 and 3 years of age relevant to representing conflicting perspectives, either in competence or in performance. On the one hand, it may be that 2-year-olds were unable to express their early competencies in

the current study. On the other hand, lying may minimally requires some executive abilities such as the ability to suppress salient knowledge (i.e., one's own perspective) while providing counter-factual and false perspectives for others at the same time (Moses, 2001). Although children of both age groups informed the competitor less often than the friend, the competence to withhold true information seemed to substantially improve around the age of 3 years. In contrast, research from interaction-based measures suggests that even young infants have a ToM (D. Buttelmann et al., 2009, 2014; F. Buttelmann et al., 2015; Carpenter et al., 2002; Knudsen & Liszkowski, 2012b; Southgate et al., 2010). However, these findings are amenable to leaner interpretations as it is unclear whether infants represent different perspectives simultaneously at the moment of test (Tomasello, 2018). Thus, these measures do necessarily require maintaining conflicting perspectives. Moreover, the findings have been shown to be difficult to replicate (Dörrenberg et al., 2018; Priewasser et al., 2018; Wenzel et al., 2020). In the current study, we used a novel approach with an interactive lying paradigm requiring representing conflicting perspectives at the same time.

Our findings support the view that communication initially entails the sharing of perspectives and an understanding of whether or not a perspective is shared with others. While the ability for shared reference is present already in the second year of life (Liszkowski, 2018), however, lying seems to be a developmental outcome at the age of 3 years. A developmental synthesis of both these views is that while 1-year-olds are able to align perspectives and provide needed factual information, only older children are able to confront perspectives and intentionally provide hindering, non-factual information, because only older children have a conception of false beliefs in the sense of conflicting perspectives (Liszkowski, 2018; Moll et al., 2016; Tomasello,

2018). It seems likely that children's understanding and implementation of false beliefs is mediated through social interactional experiences.

5. Study 3: Four-year-olds adapt their lying to the epistemic states of others

5.1. Introduction

Human communication requires understanding and adapting to others' epistemic states in order to coordinate with one another on a mental level. However, a pertinent question is to what extent this form of adapted communication involves indeed a mental understanding of others' epistemic states as subjective representations of the world, or rather simpler forms of behavioral or perspective alignment (Apperly & Butterfill, 2009; Barr & Keysar, 2005; Moll et al., 2013; Tomasello, 2018). A fuller understanding of others' subjective epistemic states in communication is best revealed in cases in which perspectives are not aligned but in conflict, as, for example, when lying. This is because perspective conflicts require holding one's own perspective in mind, while simultaneously representing a different perspective (Dennett, 1978; Perner, 1991). The ability is typically assessed with the verbal standard false belief task, which is passed around the ages of 4 to 5 years (Wellman et al., 2001). However, experimental research has not directly addressed whether young children indeed adapt their spontaneous communication to the subjective epistemic states of a recipient.

On the one hand, even 1-year-olds communicate meaningfully about external entities and events by adapting their communication to the interlocutor's information states (Liszkowski et al., 2007; Moll et al., 2006). For example, they provide information about the location of a hidden object more often to a person who lacks that information than to a person who already knows where the object is hidden (Knudsen & Liszkowski, 2012a). However, these cases rather involve an aligning of perspectives than coordinating conflicting perspectives (Liszkowski, 2018; Tomasello, 2018). On

the other hand, in search of non-verbal false belief tasks for infants, several recent studies have employed novel interactive communication paradigms trying to implement a perspective conflict (Buttelmann et al., 2009; Knudsen & Liszkowski, 2012b; Southgate et al., 2010). However, positive findings in these paradigms have often been difficult to reproduce (Dörrenberg et al., 2018; Priewasser et al., 2018; Wenzel et al., 2020; but see Baillargeon et al., 2018; and responses by Poulin-Dubois et al., 2018). Moreover, these paradigms have not truly implemented perspective conflicts, because they do not require that infants maintain their own perspective at the moment of test (Southgate, 2020; Tomasello, 2018). It has been argued that infants may simply register an adult's knowledge state (Low et al., 2016; Rakoczy, 2012) and then determine his goal (Priewasser et al., 2018). They may understand whether a perspective is or is not shared – but they may not represent two conflicting perspectives at the same time.

Lying provides a better test case. Conceptually, when lying, one intends to manipulate the belief of the recipient such that she believes something that conflicts with one's own belief, in order to prevent her from pursuing a goal that is in conflict with one's own. Research suggests that children gradually begin to lie between 2 and 4 years of age, when they first deny transgressions, then adhere to politeness conventions, or later are instructed in experimental tasks to compete (Talwar & Crossman, 2011). The cognitive complexities of early lying, however, have been contested (Sodian et al., 1991), and to date, evidence about underlying cognition derives from synchronic correlations between instructed lying and passing explicit false belief tests (Ding, Heyman, Fu, et al., 2018; Ding, Heyman, Sai, et al., 2018; Lavoie, Leduc, et al., 2017; Lavoie, Yachison, et al., 2017; Ma et al., 2015; Talwar, Crossman, et al., 2017; Talwar, Gordon, et al., 2007; Talwar & Lee, 2008). It is currently unknown whether children

adapt their lying appropriately to a recipient's epistemic states, for instance, when she is ignorant about a situation or has a false belief or already knows the truth.

Previous research has shown that 4-year-olds adapt their lying in the context of physical and informational counterevidence. In a study (Evans et al., 2011), when children transgressed a rule not to look under a cup, the cup's content spilled and left evidence behind. With age, children's excuses for why the content had spilled increased in sophistication and correlated significantly with Theory-of-Mind understanding and inhibitory control. In another recent study (Fu et al., 2012), 4-5-year old children were asked not to peek at a toy in the experimenter's absence. Then, the experimenter questioned them about their transgression in the presence or absence of an eyewitness of their transgression. 4- and 5-year-olds were more likely to tell a lie when there was no eyewitness, whereas 3-year-olds lied indiscriminately. When the experimenter was genuinely knowledgeable because the eyewitness had informed her about the transgression, 3-year-olds were less likely to lie than when the experimenter only bluffed because he had been informed by a clearly non-knowledgeable person.

These findings thus suggest that around 4 years of age, children begin to modify their lying as a function of the recipient's knowledge. However, it is currently unclear to what extent this is based on an understanding of the subjective belief states of the recipient. For example, it is possible that children's decision to lie followed their probabilistic expectation that others are less likely to adopt and share their lies in the face of available physical or communicated counterevidence. Further, a possible confound in the Fu et al. (2012) study is that in the eyewitness condition, two adults were present during the critical question, but in the control condition, only one adult

was present during the critical question. This may have resulted in an authority bias to lie less when faced with multiple authorities.

In the current study, we tested directly whether children would adapt their communication to the recipient's epistemic state, independent of a possible authority bias, and manipulated experimentally whether the recipient was ignorant about an object's location, held a false belief, or already knew about its location. The logic of such experimental manipulation is that it provides direct evidence of whether a communicator adapts to the subjective representations of a recipient. Cognitively, it discerns a simple understanding of whether information is or is not shared from a more complex understanding of holding different epistemic perspectives at the same time. When a competitor (truly) believes that *p*, to the disadvantage of the communicator, the communicator could manipulate the belief and provide a different perspective (i.e. lie). In contrast, when a competitor (falsely) believes that *q*, to the advantage of the communicator, the communicator would not need to manipulate the belief and could spare the effort of lying (and perhaps communicating at all). A third case, *ignorance*, sits on the fence. Some theories hold that children initially go by a rule that ignorant people will always err, suggesting that early passing of false belief tests simply reflects an understanding of ignorance (Perner & Ruffman, 2005). On that account, when a competitor has no specific belief that *p* or *q*, the communicator would expect him to commit a mistake, to the advantage of the communicator, and should thus behave as in the false belief scenario. In contrast, other theories suggest that children expect ignorant persons to perform at chance or even mostly get it right (Friedman & Petrashek, 2009; German & Leslie, 2001; Hulme et al., 2003). On those accounts, when a competitor has no specific belief that *p* or *q*, the communicator would expect the competitor to act

possibly, or typically, to the disadvantage of the communicator, who should thus behave as in the true belief scenario and lie accordingly.

We used a modified version of a recently employed interactive paradigm in which participants could spontaneously deceive a competitor (Heinrich & Liszkowski, 2021). Children participated in a puppet play in which a competitor puppet was trying to steal a toy from the child, which was hidden in one of two boxes. Previous findings showed that about half of 3-year-olds spontaneously misinformed an ignorant competitor to search for the toy in the false (empty) box, and that misinforming correlated positively with passing the standard false belief task (Heinrich & Liszkowski, 2021). In the current study, the toy was hidden in one of two boxes and we manipulated the competitor's epistemic state: He either did not know where the toy was (ignorance condition) or had a false belief (false belief condition) or a true belief (true belief condition) about its location. In all three conditions, the competitor then left the scene for a moment, so that it was possible that the situation could change again during this time – thus making it credible to communicate later additional information to the competitor. Accordingly, as outlined before, lying was more or less relevant depending on the competitor's epistemic state. Therefore, we planned a priori directed comparisons. These concerned the comparison between true and false belief conditions. We tested the directed hypothesis that children adapted their lying to the recipient's epistemic states: Children should lie more often when the competitor had a true belief compared to when the competitor already held a false belief. Further, children should remain silent (inactive) more often when the competitor already had a false belief compared to when he had a true belief. Importantly, children should adapt their behavior in anticipation of the competitor's behavior, that is, before it was clear from

his behavior where he would search for the object. We assessed further whether children would physical hinder the competitor more often when he had a true belief compared to when he held a false belief (see Sodian, 1991).

A second set of planned comparisons regarded the ignorance condition in comparison to the true belief condition and in comparison to the false belief condition. Here, because of alternative hypotheses (see above), we did not predict a direction of differences. If children simply went by the rule that ignorant persons always err, the pattern should differ significantly from that in the true belief condition. Alternatively, if children understood that ignorant persons could sometimes, or often, get it right, the pattern should be different from that in the false belief condition.

In addition, we assessed Theory of Mind (ToM) with a knowledge-ignorance and a standard false belief test. If the effect of adaptive lying was related to skills for passing the explicit standard false belief test, the expected directed difference between the true belief and the false belief conditions should only occur for children passing a standard false belief test. Further, based on previous research, lying should be correlated with passing the standard false belief task. Since spontaneous lying should occur mostly in the true belief condition, and perhaps in the ignorance condition, but be withheld in the false belief condition, we expected spontaneous lying in the former two conditions to be positively correlated with passing the standard false belief task. The study was pre-registered at the Open Science Framework (https://osf.io/4y563).

5.2. Method

5.2.1. Participants

Seventy-six 4-year-old children (M = 55.25 months, SD = 3.72 months) participated in the study. Participants were recruited from the Department's database of

parents who had agreed to participate in child studies. Eleven children (14 %) were excluded from analyses because they had stated in a comprehension check at the end of the session that they liked it when the bear stole the toys, suggesting that they misunderstood the narrative frame of the paradigm. The final sample consisted of 32 girls and 33 boys (n = 65). Twenty-one children participated in the ignorance condition, 22 in the true belief condition, and 22 in the false belief condition.

5.2.2. Set-up and materials

The study used a modified version of a novel interactive paradigm developed by Heinrich & Liszkowski (2021). Children and experimenter sat at a table opposite each other. We used a confederate puppet ("Maxi") and a competitor puppet ("bear"), as well as seven different appealing small toys. A pink and a green box were placed on the table equidistant between the child and the experimenter within reach of the child and with a distance of 40 cm between them. In addition, there was a white 'suitcase' box, which could contain one of the boxes. A self-made green cardboard forest was attached to the left side of the table at the experimenter's side. Four cameras recorded the child and the experimenter during the experiment.

5.2.3. Design & Procedure

The study was conducted in accordance with the Declaration of Helsinki and the procedure was approved by the local ethics committee. Before the beginning of the experiment, parents gave informed consent. The experimenter engaged in an informal warm-up with children to get acquainted. Children participated in two standard ToM tasks and in the novel interaction task. Children were randomly assigned to one of three conditions in the interaction task: The ignorance condition, false belief condition, or true belief condition (between-subjects design).

5.2.3.1. Theory of Mind tasks.

The experiment started with a knowledge-ignorance task (Hofer & Aschersleben, 2007; Wellman & Liu, 2004a) and an explicit false belief task (Wimmer & Perner, 1983). The tasks further served to get children more familiar with attending to the experimenter's stories and interacting with the experimenter. Both tasks were spatially separated from the lying task and conducted on the floor next to the table. In the knowledge-ignorance task the participant had to judge whether another girl (Playmobil figure) knows what is in a drawer (a dog) when only the participant has seen inside. The participant passed the task when answering the target-question "Does the child know what's in the drawer?" correctly. In the False Belief Task, which was enacted with two Playmobil figures, the experimenter told the participant a story about a girl Sally who put her ball into a basket. In her absence, her little brother put the ball from the basket into the box. The participant passed the task when answering the question "Where will Sally look for her ball?" correctly.

5.2.3.2. Interactive lying paradigm.

The interactive lying paradigm consisted of three introductory trials and four test trials. The introductory trials familiarized the child with the puppets and their goals (trial 1), and then demonstrated a true belief scenario (trial 2) and a false belief scenario (trial 3) and their respective outcomes. The three introductory trials were the same for all conditions. In the first introductory trial, Maxi introduced himself to the child, demonstrated a new toy and shortly played with the toy together with the child. Then, the competitor puppet appeared behind the cardboard forest with a characteristic lower-voice melody hummed by the experimenter ("Dumdidum") and shortly greeted the child in a low voice ("Hello there"). After having detected the toy on the table, he went

for the toy, took it and disappeared behind the cardboard forest. Outside the child's view, he triumphed that he had stolen the toy and would now break it. Maxi expressed frustration ("Oh no!") and told the child that they could not play with the toy anymore, because the bear had broken it. The procedure in the second introductory trial was the same as in the first introductory trial, except that Maxi hid the toy in one of the boxes as soon as they could hear the competitor's characteristic melody. However, without Maxi noticing, the competitor appeared behind the cardboard forest in time to secretly witness the hiding process. After the hiding process, the competitor shortly disappeared behind the forest to get his suitcase ("I'll get my case"). Shortly after, Maxi also excused himself and briefly left. Then, the competitor re-appeared with his suitcase and went straight for the box with the toy, put the box in his suitcase and disappeared behind the cardboard forest. Again, outside the child's view, he triumphed that he had found the toy and would now break it. Maxi then returned with the empty box, which he had found under the table, and told the child that they could not play with the toy anymore, because the bear had broken it. In the third and last introductory trial children witnessed a successful trickery. As in the second introductory trial, Maxi inserted the toy in one of the boxes, again while the competitor was secretly watching from behind the cardboard forest. This time, however, Maxi was aware of the competitor's presence. As soon as the competitor shortly disappeared to get his suitcase, Maxi sneakily changed the toy's location without the competitor witnessing, then excused himself and briefly left. Thus, when the competitor re-appeared, he went straight for the now-empty box, put it into his suitcase and disappeared behind the cardboard forest. This time, again outside the child's view, he expressed frustration that there had been no toy to break

inside the box. Maxi returned with the empty box and expressed joy that he had tricked the bear. He offered the child to play with the toy again.

The introductory trials were followed by four test trials, each consisting of three sequences: hiding; relocation; raid. Depending on the condition, the competitor was present or absent during the hiding process and relocation. Figure 7 displays the procedure in the false belief condition.

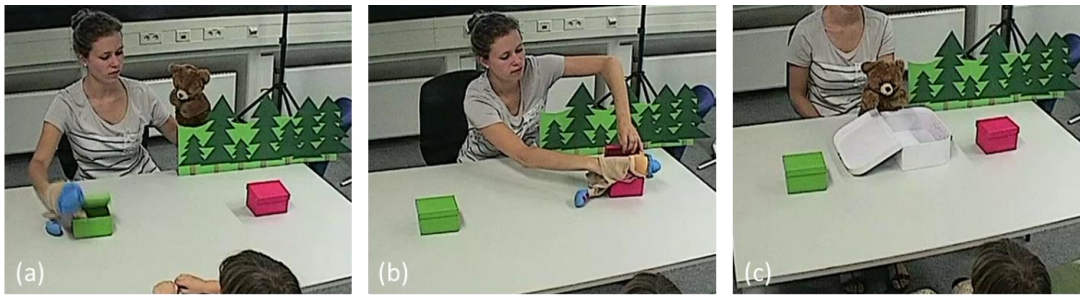

Figure 7. Procedure in the false belief condition: (a) hiding process in the competitor's presence, (b) relocation in the competitor's absence, (c) raid.

Each test-trial started with the presentation of a new toy. Maxi and the child shorty played together with the toy. In the ignorance condition, the competitor appeared, detected the toy ("Oh, such a nice toy") and immediately went back to the forest in order to get his suitcase ("I want to steal the toy, but I have to get my suitcase first"). In his absence, Maxi hid the toy in one of the boxes, but then changed his mind, and relocated the toy into the other box. In the true belief condition, the procedure was the same, except that the competitor witnessed the hiding process and the relocation before going back to the forest in order to get his suitcase. In the false belief condition, the competitor witnessed the hiding process, but then went back to the forest to get his suitcase and, thus, was absent during the relocation. In each trial, after the relocation,

Maxi asked the child whether she still knew where the toy was. All children correctly remembered the toy's actual location.

The competitor's raid consisted of two phases. The phases were the same for all conditions. In the anticipation phase (~ 10 s), the competitor appeared behind the forest with his suitcase and the characteristic lower-voice melody. He slowly approached the middle of the table, put down his suitcase between the two boxes and shortly paused in this position. In the choice phase (~ 10 s), he went for the box that was congruent with his mental state (true belief condition: full box, false belief condition: empty box, ignorance condition: 50% of trials full box, 50% of trials empty box). He put the box into his suitcase and disappeared with the suitcase behind the cardboard forest. Outside the child's view, he expressed joy or frustration, depending on his success or failure to steal the toy. As soon as the child indicated a box through communication, the competitor directly approached the referred-to box, independent of raid phase and mental state. After the four test trials, the experimenter asked the child a final comprehension question "Do you like it when the bear steals the toys?"

5.2.3.3. Evaluation Task.

As part of another exploratory research question not central to the current study (for more information see supplements), the experimenter asked the child to evaluate her behavior in the interactive paradigm explicitly. For each behavior that had occurred at least once during the test phases, the experimenter asked the child at the end of the testing, after all trials had been completed: "Do you think it was the right behavior that you (withheld the information/ tricked/hindered/helped the bear)?" and "Why do you think this was the right behavior?" or "Why do you think this was the wrong behavior?"

5.2.4. Coding and Reliability

Two naïve raters coded children's behavior during the interactive experiment. Main response measures were lying, physically hindering, and withholding of information. Lying was coded when the child provided false information leading the competitor to fail achieving his goal (e.g., pointing to the empty box, offering the empty box, verbal lies with reference to the empty box). Physically hindering was coded when the child's direct physical object-directed actions hindered the competitor to achieve his goal (e.g., blocking access to the toy, removing the box with the toy). Withholding of information was coded when the child did not show any communicative or hindering behavior, but instead withheld the information during all phases of the trial. Lying and hindering were coded independently at their first occurrence and could occur in the same trial and phase. Interrater-reliability was excellent with Cohen's κ =.92.

5.2.5. Analytic strategy

Main dependent variables were the mean proportion of trials with anticipatory lying, physical hindering and withholding of information. To answer the main research question whether 4-year-olds adapt their behavior to the competitor's epistemic state in anticipation of his behavior, that is before he approaches one of the boxes, we analyzed lying, hindering, and withholding of information in the anticipation phases across conditions with a mixed analysis of variance (ANOVA). Interactions were resolved through our planned comparisons based on the variance of the omnibus ANOVA following the predictions of the study. Predictions regarding the comparisons between false belief and true belief conditions followed the directed hypothesis based on one-sided probabilities; predictions regarding the comparisons between the ignorance condition and the other two conditions were not directed. In an additional analysis, we

looked at behaviors during the entire trial. To test whether the predicted effect of adaptive lying was related to children's passing of the explicit false belief task, we ran pairwise comparisons between the true belief and false belief conditions for children passing/failing the standard false belief task. To confirm previously found relations between spontaneous usage and explicit ToM, we tested for correlations between lying children in the ignorance and true belief conditions and their passing of the standard false belief task.

5.3. Results

Main analysis

Figure 8 displays the mean proportion of anticipatory behaviors across conditions. A 3 (Anticipatory behavior) x 3 (Condition) ANOVA revealed a main effect of anticipatory behavior, $F(2, 59) = 8.19$, $p < .001$, $\eta^2 = .122$, and a significant interaction between anticipatory behavior and condition, $F(4, 59) = 3.64$, $p = .008$, $\eta^2 = .110$. The planned comparisons following the directed hypothesis revealed significantly more lying in the true belief than in the false belief condition, mean difference = .202, $p = .046$, one-tailed. Furthermore, as expected, withholding of information was more frequent in the false belief condition than in the true belief condition, mean difference = .381, $p = .002$. Finally, while anticipatory hindering was more frequent in the true belief condition than in the false belief condition, the difference failed to reach statistical significance. In the ignorance condition, withholding information was significantly less frequent than in the false belief condition, mean difference = .343, $p = .005$. For the other two measures, the ignorance condition did not significantly differ from true and false belief conditions.

When analyzing the behaviors during the entire trial, the pattern of findings from the anticipation phase remained significant: Interaction between behavior and condition, $F(4, 59) = 3.75$, $p = .007$, $\eta^2 = .113$; more lying in the true belief than in the false belief condition, mean difference = .226, $p = .039$, one-tailed; more withholding of information in the false belief than in the true belief condition, mean difference = .381, $p = .002$ and in the ignorance condition, mean difference = .343, $p = .005$. In addition to the pattern in the anticipation phase, physically hindering was significantly more frequent in the true belief compared to the false belief condition, mean difference = .167, $p = .033$.

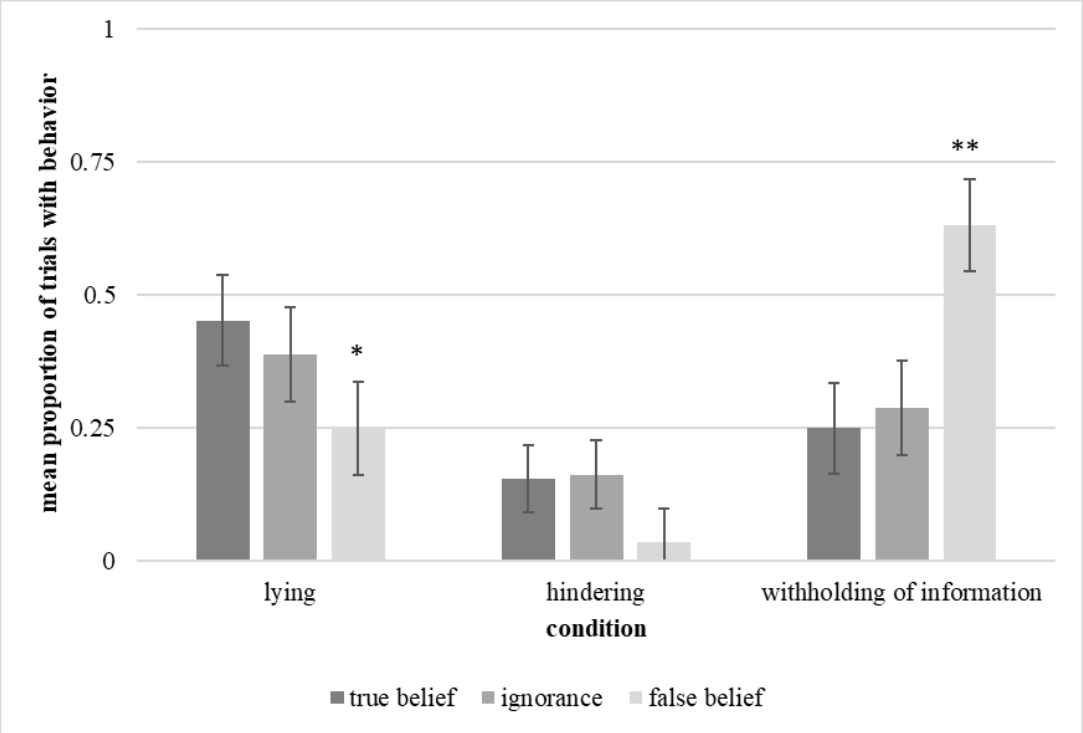

Figure 8. Mean proportion of trials with anticipatory behavior in the true belief, ignorance and false belief condition. Bars indicate standard errors of the mean.*significantly different from true belief, $p < .05$; **significantly different from true belief and ignorance, $p < .01$.

Relations to ToM tasks

Fifty-five percent of the participants passed the explicit false belief task, with no differences between conditions. The effect of adaptive lying, that is, more lying in the true belief condition than in the false belief condition, was present for children who passed the explicit false belief test, $t(18) = 2.66$, $p = .016$, but not for children who failed the explicit false belief test, $t(19) = .463$, $p = .649$. Further, as expected from previous findings, children who lied (at least once) in the true belief and ignorance conditions were more likely to pass the standard false belief task, $\varphi(41) = .373$, $p = .017$. Ninety-two percent of the participants passed the knowledge-ignorance task, with no difference between conditions. Accordingly, performance reached ceiling and was not considered for further analysis.

5.4. Discussion

The current study manipulated a recipient's epistemic states experimentally and found that 4-year-old children adapt their communication appropriately depending on whether the recipient was ignorant about a situation, or had a false belief, or already knew the truth. To prevent a competitor from interfering with their goal, children withheld information in the false belief scenario, and lied selectively in the true belief scenario. The effect of adaptive lying was most pronounced in children who passed the explicit standard false belief test.

Importantly, the main analysis pertained to the anticipation phase in which it was not apparent from the competitor's behavior, which box he would approach. On procedural grounds, we can thus exclude that children simply saw what happened and just reacted according to the unfolding event. Instead, children anticipated what the competitor would do and intervened proactively by communicating.

Children discriminated between true and false beliefs in their lying and withholding of information, which reveals that their anticipating was based on an understanding of others' subjective epistemic states. Crucially, the intention to lie presupposes pursuit of a goal according to one's own representation of reality. While the participant's own representation of reality is routinely captured in ToM-research with explicit memory questions, it is typically not assessed in corresponding interactive paradigms, which makes those studies amenable to leaner interpretations (Southgate, 2020; Tomasello, 2018). In the current study, however, all children knew where the object was hidden. Accordingly, they implanted a false belief when appropriate to coordinate the competitor's actions with their own goal. Cognitively, this requires holding in mind both, one's own and another's perspective. Findings further revealed that children differentiated between ignorance and false belief conditions. This suggests against the interpretation that children in the false belief condition only understood that the competitor 'does not know' where the object really is (Ruffman, 2014). Instead, they understood that he represented the object to be in the empty box while they knew it to be in the full box.

Previous research has been correlational in establishing a link between explicit lying and passing the explicit standard false belief task. In line with this, the current results revealed a correlation between spontaneous lying and passing the explicit false belief test. However, the current study went beyond a correlational design. It revealed experimentally that children's understanding of subjective epistemic states is causal to adapting their communication. The effect of condition differences was present in children who passed, but not in children who failed the explicit false belief task. Since there were no differences between conditions in passing the explicit false belief task,

results were not an artefact of imbalances in the sampling procedure. This finding thus establishes an empirical relation between false belief understanding in spontaneous interaction and false belief understanding revealed by explicit test questions. Previous theories have suggested distinct systems to govern spontaneously displayed versus elicited knowledge (Baillargeon et al., 2010), or implicit and explicit forms of ToM (Apperly & Butterfill, 2009). The current finding of an empirical relation between children's adaptive spontaneous communication and their explicit reasoning about others' minds rather suggests a unified system, at least by the age of 4 years.

One could argue that lying is not always an option to hinder a competitor, especially in cases in which the recipient is clearly knowledgeable. However, while previous research has shown that children refrain from lying in the face of physical evidence and counter-information (Evans et al., 2011; Fu et al., 2012), in the current design the competitor shortly disappeared before his raid, so that it was possible that the situation changed in-between. Further, upon his return, no obvious counter-evidence was available. We argue that it is precisely in such situations that lying becomes a viable strategy, if the communicator indeed understands that the recipient's actions will be based on his beliefs.

One could also argue that it would have been safest in the current experiment always to hinder the competitor physically to prevent him from stealing the toy. Instead, however, lying was more frequent than hindering and it was selective to conditions. Indeed, hindering occurred differentially only when including the approach phase into the analyses, suggesting that it mostly worked as a reaction to the competitor's actions. Following relevance theory (Sperber & Wilson, 1995), one suggestion is that children lied less in the false belief condition in order to spare effort and not be 'over-

informative'. Adherence to the principle can already be detected in 1-year-olds' selective informing of someone in need of information (Knudsen & Liszkowski, 2012a). On this view, it is further possible that physical hindering was less frequent and occurred later than communicating because it is more effortful. Another possibility is that physical hindering is perceived as a stronger anti-social act than lying, and disfavored from early on (e.g., Hamlin, 2013). On the latter view, children perhaps attempted to change the competitor's perspective in order for him to change his decision accordingly, so that they then did not need to intervene physically. Methodologically, we note that the current study intentionally employed a between-subjects design, so that children would not have to contrast different situations (beyond the introductory scenes), in order not to get confused. It is theoretically possible that a within-subjects design could lead to adopting a global strategy of always hindering or lying.

Coordinating with others requires coordinating perspectives. While 1-year-olds align perspectives with others, by 4 years of age, children also provide perspectives that conflict with their own. Current experimental findings reveal that children adapt their providing of conflicting perspectives to a recipient's epistemic states. Children use this form of lying flexibly to coordinate with a competitor on a mental level and defend their own plan of action when necessary. This form of adaptive lying demonstrates a practical usage of ToM in action. Our findings of a synchronic relation to explicit ToM reasoning suggest a common underlying system. It will be productive to relate its development to infants' earlier forms of aligning perspectives, and to children's further development of explicit social and moral reasoning, to advance our understanding of the nature of human perspective-coordinating cognition.

5.6. Supplementary Material

Children's post-hoc evaluations

In addition to the main study, we ran exploratory analysis on how children would evaluate their lying depending on the recipient's mental state. Research suggests that children evaluate lies differently depending on the social context and its implications for others (G. D. Heyman et al., 2009; Xu et al., 2010). For instance, children evaluate lies more favorably in politeness contexts than in transgression contexts.

Of those children who lied, 97% evaluated their behavior as the right behavior. Only one child evaluated his lying as the wrong behavior. When asked why they thought of their behavior as the right behavior, 68% justified their lying with the competitor's moral offense (e.g., "He wanted to steal the toy"). The same pattern held for physical hindering, with all children evaluating their hindering as the right behavior and 50% arguing with the competitor's moral offense and the rest being inconclusive. Ninety percent evaluated withholding the information as the right behavior, 29% arguing with the competitor's moral offense and 26% arguing with his mental state (e.g., "Because he did not know where the toy was") and 5% arguing with their feelings ("I didn't like him"). Only four children from the ignorance or true belief condition evaluated withholding the information as the wrong behavior, but no child from the false belief condition evaluated withholding the information as the wrong behavior. Due to the overall high level of right evaluations, we did not compare the proportion of children who evaluated their behavior as the right or wrong between or within conditions. Finding that most children evaluated their lying as right may suggest that they experienced a strong intuition that stealing the toy is a moral offense and should be

prevented. Further, they may not have expected self-disapproval for their lying. Research suggests that a search for self-justification when lying emerges only later in childhood (Maggian & Villeval, 2016). More, most children may have evaluated their lying as the right behavior, because the word “trick” used in the evaluation questions has a less negative connotation than the word “lie” (Wimmer et al., 1985). Alternatively, children may have also succumbed to a ‘yes’-bias in answering the questions (Fritzley & Lee, 2003).

6. Study 4: The emergence of lying for reputational concerns in 5-year-old children

6.1. Introduction

Young children engage in strategic behaviors to manipulate the impressions others form of them. The aim of this study is a first step in the process of investigating whether children also lie to manage their reputation, e.g. when being asked about their generosity by peers. Research suggests that 5-year old children behave more prosocially in the presence of others (Engelmann & Rapp, 2018). They share more and steal less when they are being watched by a peer than when they are alone (Engelmann et al., 2012; Yazdi et al., 2020). More, they are less likely to cheat in a guessing game, if they are told that they have a positive reputation to maintain, even if nobody is watching them and if not to cheat conflicts with their personal interest (Fu et al., 2016). In contrast, telling children that they have a reputation for being smart results in more lying in 3-5-year-olds in a guessing game (Zhao et al., 2018). This suggest that even 3-year old children are responsive to reputational cues in their morally relevant behavior. With age, children start to explicitly reason about intentions and social outcomes. By eight years of age, they are more generous in a sharing game not only when their behavior is observed by a third party, but also when it can affect their chances of being chosen for a subsequent game (Herrmann et al., 2019). More, 8-year-olds begin to understand ulterior motives. They reason that children who offer gifts to others in public compared to private settings might have an ulterior motive to enhance their reputation (G. Heyman et al., 2014). Further, they understand that excessively promoting one's own good deeds can have negative reputational consequences, and show modesty to manage their

reputation by falsely denying their good deeds (Fu et al., 2016). These modesty-related lies seem to be particularly influenced by cultural socialization. Taken together, these results suggest that, from an early age, children manage their reputation in order to be socially accepted and to cooperate with others (Engelmann & Rapp, 2018; Herrmann et al., 2019). Yet, lying for reputational concerns is still poorly understood. Do children not only underplay, but also overstate their prosociality in order to manage their reputation and to cooperate with others? And, when do they begin to make deliberately untrue statements for reputational concerns? The current study is the first to examine whether lying for reputational concerns is present at the age of five years, the same age when children begin to engage in other strategic behaviors to manage their reputation. This study thus offers important insights into the development of reputation management and should make an important contribution to the field of social cooperation.A characteristic adaptation for human social cooperation and cultural life is the ability to take the group's perspective and to care about the group (Tomasello, 2019). Research suggest that children show loyalty to their group from early on. For instance, they are less likely to reveal the secret of an ingroup compared to an outgroup member (Misch et al., 2016) and they are less likely to blow the whistle on their ingroup than on the outgroup (Misch et al., 2018). Young children are loyal to their group, even if it comes with personal costs. With age, children become more likely to tell lies to benefit the collective (Fu et al., 2008). However, it is unclear whether children are also willing to lie about their group's generosity to peers in order to manage their group's reputation. Moreover, research suggests that 5-year-olds have selective reputational concerns with ingroup and outgroup members and care more about their reputation with potential reciprocators, than with individuals with whom they would not later interact

(Yazdi et al., 2020). They exhibit an ingroup bias when distributing the resources by sharing more with an ingroup member than with an outgroup member, and they evaluate ingroup sharing as nicer than outgroup sharing. Further, children share more resources with an anonymous recipient, if they are watched by an ingroup rather than an outgroup member (Engelmann et al., 2013). Accordingly, children may exhibit a group bias when lying for their or their group's reputation.

In sum, this study was a first attempt to examine the emergence of lying for reputational concerns in 5-year-olds and to explore potential group biases. In the current study, participants played a mini dictator game (Rapp et al., 2019) in which they could share all, none or any number of their or their group's stickers with another child. In the individual reputation condition, children donated individually, whereas in the group reputation condition the group donated collaboratively. In both conditions, the ingroup and outgroup members were revealed to the children via a pre-recorded Skype call. After the donation game, an ingroup and an outgroup member called separately with the first child counterbalanced across participants. Both children asked the participant how many stickers she or the group donated. The participant's answers were compared to the actual number of donated stickers and the difference scores were considered as lying scores. A background assumption born from previous research was that children would distribute the stickers in their favor (Smith et al., 2013). If lying for reputational concerns emerges at the age of five years, children should lie about the amount of donated stickers in the individual reputation condition with their verbal statement exceeding the number of donated stickers. If five-year-olds use lying in order to manage their group's reputation, they should lie about the amount of donated stickers in the group reputation condition with their verbal statement exceeding the number of donated

stickers. If there are differences in lying for the individual or for the group's reputation, children should lie more in one than in the other condition. If children experience group biases for reputation management, answers to the ingroup and outgroup member should differ.

6.2. Materials and methods

6.2.1. Participants

In total, 55 Caucasian 5-year-olds participated in this study (Mean age = 65.58 months, *SD* = 3.75). Participants were recruited from the department's database of parents who had agreed to participate in child studies. Twenty-seven children were included in the individual reputation condition (13 girls) and 28 children were included in the group reputation condition (13 girls). Eighteen children chose to be in the red group and 16 to be in the blue group with an equal distribution across gender. This study was pre-registered at the Open Science Framework (https://osf.io/ck234).

6.2.2. Design & Procedure

This study was non-invasive and conducted according to the national ethics guidelines. Before the beginning of the experiment, parents gave written informed consent. After a short warm-up with the experimenter, children were randomly assigned to one of two between-subjects conditions: The individual reputation condition or the group reputation condition. In both conditions, the child could choose between becoming a member of the blue or the red group by choosing to wear a blue or red hat (minimal group paradigm). Next, the experimenter presented a blue or red bag (matching the participant's group), and a gray bag to the participant and explained that the blue or red bag and everything it contains belonged to the participant or her group and the gray bag and everything it contains belonged to another child. In both conditions,

participants then played a mini dictator game (Rapp, Engelmann, Herrmann, & Tomasello, 2019). The participant received 10 small yellow plastic containers and the experimenter explained that each container contained a sticker and that they could keep them and take them all home (in the group condition: they could keep them as a group and split them up later to take them home) or share some with another child who does not have any stickers. Participants did not see the actual stickers to avoid individual preferences for the stickers. Participants were told to place the (closed) containers they wanted to take home in their bag and that they could share some of their containers with the other child by placing them in the gray bag. Participants were thus free to share all, none, or any other number of their containers. In the individual reputation condition, children donated individually whereas in the group reputation condition the group donated collaboratively. Therefore, in the group condition, an ingroup member was revealed to the participant via a pre-recorded Skype call before the allocation process started. The ingroup member asked the participant how many stickers their group should donate to the other child and agreed upon the participant's suggestion. It is important to note that all participants in the group condition naturally interacted with the other child, suggesting that they were not aware that this was an artificial interaction with a pre-recorded video. Then, the participant was asked to allocate the (group's) stickers while the experimenter was out of the room. The experimenter reentered when the child had allocated the stickers and took the bags out of the room.

Next, the experimenter told the participant that four other children just played the same game in a different room. The four children were presented in a pre-recorded Skype group call and introduced themselves in an interactive process with the experimenter to make participants believe that this was an online interaction. Two

children, one boy and one girl, were ingroup members wearing the same hat as the participant (one was already known in the group reputation condition from the allocation decision). The other two children, one boy and one girl, were outgroup members wearing a hat in a different color. As a reminder, the experimenter asked the participant about her group membership after the call. Then, the experimenter told the participant that an ingroup and an outgroup member would call separately, because they had a question for the participant. The experimenter encouraged the participant to talk to the children and then left the room. The ingroup member always had the same sex as the participant, and the outgroup member had the different sex. The order of the calling children was counterbalanced. Figure 9 displays the setup during the individual skype calls.

Figure 9. Setup during the individual skype calls (test questions).

Both children asked the participant the test question how many stickers she or the group donated to the other child. The participant's answers were compared to the actual number of donated stickers and the difference scores were considered as lying scores. After the individual Skype calls, with a delay of approximately five minutes to the actual donation, children completed a memory check. For the memory check, the experimenter opened the bags behind a barrier and asked the child if she remembered how many stickers she or the group donated to the other child. This procedure made it clear for the participant that the experimenter could see the bag's content and lying would be meaningless. Finally, participants completed a perceived norm task. In the perceived norm task, the experimenter told the participant a story about a girl Kim (for boys: about a boy Paul). Kim got 10 candies and could now share some of the candies with another child. The experimenter asked the participant how many candies Kim or Paul should share with the other child, if the donation would be made public afterwards.

6.2.3. Analytic strategy

Our main dependent variables were the number of donated stickers, the memory check and the perceived norm. Two lying scores were calculated, an ingroup lying score and an outgroup lying score (answer to test question minus number of donated stickers). We ran mixed between-within subjects analysis of variance (ANOVA) to analyze our results. The categorical independent between-subjects variable was condition and the categorical independent within-subjects variable was group. The continuous dependent variable was the lying score. Further, we compared children's actual donation to their perceived norm in a paired-sample t-test. For an exploratory analysis, we only included children who were in a moral dilemma, i.e. children who shared less than they perceived

as fair, because otherwise lying about the amount of donated stickers may have been redundant.

6.3. Results

On average, children donated 3.15 stickers (SD = 1.77) with no difference between conditions, $t(51) = .94$, $p = .35$, and no gender differences, $t(51) = .58$, $p = .56$. Seventy-six percent distributed the stickers selfishly and donated less than five stickers. Thirty-four children (62%) passed the memory check by correctly remembering the amount of donated stickers. Since lying is different from false memories, we calculated lying scores only for children who passed the memory check and who gave a numerical answer to the test questions (N = 30). A 2 (Condition: individual, group) x 2 (Group: ingroup, outgroup) ANOVA for the lying scores revealed no main effect of condition or group and no significant interaction. Thus, data was collapsed across conditions and group for the following analysis. As displayed in Figure 10, for those children who passed the memory check, verbal statements exceeded the number of donated stickers, $t(29) = 2.15$, $p = .04$, with an average donation of 2.73 stickers (SD = 1.84) and a verbal statement of 3.58 stickers (SD = 2.53). There were no changes in significance when all children independent of their memory performance were included in the sample.

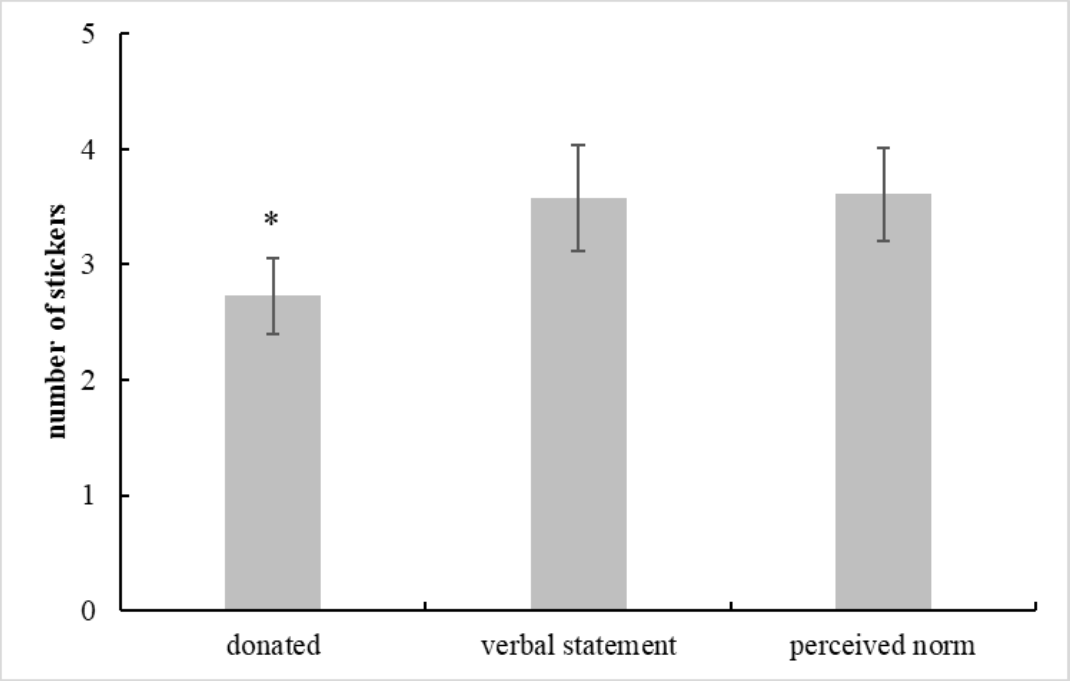

Figure 10. Number of donated stickers, verbal statements and perceived norm for children passing the memory check (n = 34). Error bars depict standard error of the mean. * significantly different from both other bars, $p < .05$.

In the perceived norm task, participants stated that Kim should share 3.61 (*SD* = 2.28) candies with the other child with no difference between conditions, $t(31) = 1.39$, $p = .175$, and no gender differences, $t(51) = 1.33$, $p = .191$. Sixty percent expected a selfish distribution and stated that Kim should share less than five candies with the other child. Still, the perceived norm was higher than the amount of donated stickers in the mini dictator game, $t(32) = 1.74$, $p = .046$, one-tailed. Having a closer look at the perceived norm task revealed that sixteen children were in a moral dilemma, that is they shared less than they perceived as fair. Of those children who were in a moral dilemma, 38% had lied about their donation (not significantly different from chance, binomial test, two-tailed, $p = .45$, n = 16). Lying was not related to being in a moral dilemma, $\Phi(35) = .18$, $p = .283$.

6.4. Discussion

This study investigated the emergence of children's lying for reputational concerns. In a mini dictator game, participants could share some of their or their group's stickers with another child. Results revealed that participants distributed the stickers selfishly, but in subsequent Skype-calls with peers, their verbal statements exceeded the actual number of donated stickers. This finding was independent of whether children donated the stickers individually or collaboratively as a group. There was no significant difference between answers to the ingroup or outgroup members. These results suggest that at the age of five years, children begin to lie for psychological rewards, such as managing other's impressions of them.

Interestingly, children's perceived norm was higher than their amount of donated stickers. This finding is consistent with that of other studies reporting a gap between children's fairness judgments and their actual behavior (Smith et al., 2013). Accordingly, even 3-year-olds know the norm of equal sharing but often do not act in accordance with this norm. They favor themselves when sharing a resource even though they state that they should share equally. Thus, before age eight, children understand the norms of fairness and are able to explicitly reason about such norms. However, they do not follow those norms in situations when sharing a resource results in less for themselves. We expected that the gap between children's actual behavior and their perceived norm ("moral dilemma") might boost lying about the amount of donated stickers, but we did not find any relation between being in moral dilemma and lying for reputational concerns. However, a potential confound is that the donation and communication with the other children may have influenced childrens' subsequent answers to the perceived norm question. Children who had lied about their donation

might have intentionally lowered their answer to the perceived norm task in order to appear even more prosocial. Finding that only forty percent expected an equal or prosocial distribution in the perceived norm task supports this claim. This effect could be prevented by counterbalancing the task order in follow-up studies. Yet, asking the perceived norm question before the mini dictator game might increase the amount of donated stickers and result in less relevance to lie.

Findings revealed no significant differences between the individual and the group condition. Yet, it can be discussed whether participants perceived the collaborative donation differently from the individual donation. In the group condition, the child in the Video always agreed upon the participant's suggestion. Thus, we cannot rule out the possibility that children in the group condition may have felt that they were deciding alone. A potential improvement to the procedure would be to use a confederate child to for the collaborative decision. Generally, the current study did not include a direct cooperation or reciprocity between the participant and the other children, and the test questions were asked via prerecorded videos rather than in a direct interaction. Yet, research suggests that children behave more generously, if their behavior can affect their chances of being chosen for a game (Herrmann et al., 2019) or if the child watching them can reciprocate later (Engelmann et al., 2013). The absence of direct cooperation or reciprocity might thus have resulted in a comparatively small incentive to lie in the current study. On the other hand, it should be mentioned that all children naturally interacted with the confederates in the video suggesting a certain similarity between the artificial and natural interactions.

While previous research has shown an increase in children's reputation management, if their prosocial behavior is displayed publicly and compared to the

behavior of other children of the group (Rapp et al., 2019), the current study did not use a competitive group setting. A direct competition between the groups might have further increased children's identification with their group and, in particular in the group reputation condition, their lying for their group's reputation.

Another limitation to the current study that should be discussed is that a number of children (36%) failed to remember the amount of donated stickers in the memory check. On the one hand, this may suggest that they had difficulties with number representation. Research suggests that many children have difficulties with responding correctly to How-Many tasks even after they have counted an array correctly (Rittle-Johnson & Siegler, 1998; Sarnecka & Carey, 2008). Thus, a less number-based design might be more suitable to answer the research question. On the other hand, the memory question may be open to intentionally false allegations. Children may choose to lie in the memory check to be consistent with the response to the test questions. Thirty-six percent of children, who had lied in the test-questions, failed the memory check. Taken together, future studies should consider these procedural and motivational aspects and implement direct interactions with the other children.

6.5. Conclusions

The current study investigated the emergence of lying for reputational concerns in individual and group settings and thus helps to gain a deeper understanding of how young children manage their reputation in interaction with peers. The results suggest that 5-year-olds do not only lie to avoid punishment, but they begin to use lying as a strategy to manage the impressions others form of their group and of the self. Based on the results, we suggest that lying for reputation management emerges earliest at the age of 5 years. However, it seems likely that lying for reputational concerns might

consolidate further with age. Further data collection and comparisons with older age groups are required to determine exactly how reputational concerns affect lying in children.

7. General Discussion

Knowing when and what to share with others is an important ability, which has an influence on social relations with others. This is crucial for cooperation and the functioning of large-scale societies. While sharing and aligning perspectives with others generally emerges early in life, when infants engage in joint attentional interactions (Tomasello, 1998), research suggests that contrasting different perspectives, i.e., intentional lying, emerges much later in ontogeny (e.g., Evans & Lee, 2013). In this dissertation, I used a new interactive paradigm to capture spontaneous lying within interactional flow and investigated in four studies when and under what social and motivational circumstances young children are able to spontaneously and strategically implant false perspectives in others. Results from the four studies revealed that children intentionally misinform others within interaction from about 3 years of age. More importantly, they do this spontaneously without being verbally instructed or questioned, and even before they are able to talk explicitly about their lying or the outcome of their dishonesty. Further, findings indicate that young children spontaneously lie in various situations and for a multitude of purposes, such as material gain, for the benefit of another person, or for reputational concern. The results further speak to a causal link between lying and false belief understanding. Taken together, results from this dissertation support children's early emerging, sophisticated communication, and ToM abilities, which are key elements underlying collaborative success.

In this chapter, I will summarize the findings once again, discuss the results in the context of previous research and integrate them into a coherent picture on the development of lying. Finally, limitations and implications for future research will be discussed.

7.1. Summary and integration of findings

In Study 1, we tested 3-year-olds in an interactive lying paradigm to shed light on spontaneous lying in young children before they pass the explicit false belief task. In the interactive paradigm, a puppet was shown to be looking for a hidden object in order to steal it from the child (competitor condition) or in order to clean it for the child (friend condition). Study 1 further investigated whether personal motivation would influence spontaneous lying and tested for relations to explicit skills of lying, false-belief understanding, inhibitory control, and socialization. The results indicate that about half of the 3-year-olds lied at least once. Children not only lied for egocentric reasons but also for the benefit of others. Further, passing the explicit false belief task and the ability to explicitly plan their lying predicted spontaneous lying in the interactive paradigm. However, explicitly planning to lie occurred less often than actual lying. These findings support the view that early and practical ToM skills serve as a basis for developing explicit false belief reasoning. Thus, the emergence of spontaneous lying likely is a seed of early ToM abilities.

In a subsequent study (Study 2), we tested 2-year-old and 3-year-old children in a modified version of the interactive paradigm. In line with previous research and associated predictions, most children in both age groups spontaneously informed the friend by pointing to the true location. Further, children applied various strategies, such as physical exclusion or lying to prevent the competitor from stealing the object. Replicating results from Study 1, selective lying was present at age 3. Contrary to the results with 3-year-olds, selective lying was absent at age 2. This confirms that children spontaneously align their perspectives with others from early on. Moreover, it suggests

that children begin to spontaneously contrast different perspectives around the age of 3 years.

In Study 3, we tested whether children would adapt their communication to the mental perspective of the other when it differed from their own. Using a modified version of the interactive lying paradigm with 4-year-olds, results revealed that children lied and physically hindered the competitor more often if he held a true belief about the object's location or was ignorant about it, compared to if he held a false belief about the object's location. Children thus adapted their lying to the competitor's subjective perspective in anticipation of his behavior, revealing a causal link between lying and false belief understanding. These results complement previous research on truthful information sharing, suggesting that it is only at the age of 7 years that children start to efficiently identify and communicate what is most important for a recipient, and consider to whom a piece of information is most relevant (Danovitch, 2020).

Study 4 tested how children engage in strategic behaviors with peers to manipulate the impressions others form of them. More precisely, we tested whether 5-year-olds would lie about their behavior in order to manage their reputation. In a mini-dictator game, participants could share all, none, or any number of their resources with another child. After the dictator game, an ingroup and an outgroup member called via pre-recorded Skype video and asked the participant about the donation. Results revealed that children's verbal statements exceeded their donation, and children donated less than they perceived as the norm. This was independent of whether they donated individually or collaboratively as a group, and there was no difference between answers to ingroup and outgroup members. However, lying for reputational concerns was not a predominant strategy as many children were honest about their donations.

While previous research revealed that young children approve of lying to promote another person's reputation (Ahn et al., 2020), the results of this study suggest at age 5, children also begin to lie to promote their own reputation. It seems likely that the ability to morally evaluate themselves and others is needed for the functioning of cooperation, and children are sensitive to reputational concerns because of the evolutionary pressure to be perceived as a prosocial partner for potential cooperation. Table 2 summarizes the results of the four studies.

Table 2. Summary of empirical research

Study	Main findings
1	3-year-olds spontaneously lied with egocentric and prosocial motivations but were less proficient in lying in an explicit analogue version. Spontaneous lying was related to false belief understanding.
2	Selective lying was present at 3 but not at 2 years of age.
3	4-year-olds adapted their lying to the recipient's subjective perspective, revealing a causal link between lying and false belief understanding.
4	5-year-olds donated less of their resource than they perceived as the norm. They lied about their donation with peers to manage their reputations.

The picture that emerges from the findings of this dissertation suggests that the ability to lie emerges before the age of 4 years and gradually becomes more sophisticated. Lying occurs for a multitude of reasons, including managing one's reputation. While younger children have difficulties with verbal falsehood, they are able to spontaneously implant false beliefs in interactions with others before the age of 4 years (e.g., by using misinforming gestures). In contrast to early deception tasks (see Chapter 1.2.1.), where children's strategies were mostly non-communicative and simply required an understanding of sabotage, not lying, the results presented in this dissertation revealed an understanding and intentional manipulation of the other

person's mental state. In Studies 1 and 2, children were not only able to physically prevent the competitor from finding the object but they also intentionally communicated false information to the recipient in anticipation of his behavior. This spontaneous contrasting of perspectives speaks against conceptual deficits in children younger than 4 years of age. Thus, lying seems to be present earlier than previously assumed and does not necessarily require the use of words. Moreover, in contrast to earlier findings on strategic deception, children in the current thesis were not explicitly prompted to lie (e.g., by direct instructions or explicit questions about the toy's location). Instead, they spontaneously manipulated the other's mental state within an interaction. The results of this dissertation suggest that lying is part of our social world and serves as a window to many aspects of the developing mind. The results thus contribute to a more comprehensive insight into children's developing understanding and spontaneous manipulation of the mental states of others. They further contribute to a deeper understanding of the relationships between spontaneous lying and social-cognitive factors.

7.2. Limitations and Implications for future research

The four studies presented in this dissertation provide an important contribution to the research on the development of dishonesty. Each study had specific limitations, which were already discussed in previous chapters. This chapter focuses on general limitations, which, at the same time, warrant opportunities for future research.

7.2.1 Validity and generalizability of results

While experimental research, on the one hand, affords a high level of control and the methods are relatively easy to replicate, it provides children with an artificial environment and may have low ecological validity. Referring to Bronfenbrenner

"much of contemporary developmental psychology is the science of the strange behavior of children in strange situations with strange adults for the briefest possible periods of time" (Bronfenbrenner, 1977, p. 513). Collecting naturalistic interactional data on the development of lying may lead to a more natural behavior and may capture the child's very first attempts to lie in settings that are difficult to replicate in the lab, (e.g., in interaction with older siblings). Thus, it seems possible that lies in naturalistic contexts emerge earlier than they may be observed in experimental paradigms. At the same time, collecting naturalistic data is time-consuming. Thus, a combination of experimental and naturalistic methods may provide much richer data and more valid insights into the development of lying in young children. Moreover, the findings of this thesis are limited by the use of cross-sectional designs. In order to better understand the development of lying, longitudinal studies are required. They may reveal predictive social and cognitive abilities for the emergence of spontaneous lying, such as ToM and executive function skills (Ding et al., 2018), and they may be more sensitive to capturing age-related changes.

Furthermore, the generalizability of the results is subject to certain limitations. First, the tasks presented in this dissertation might be tailored to children in Western, educated, industrialized, rich, and democratic (WEIRD) contexts (Henrich et al., 2010), and much uncertainty exists about how variable the constructs are and how children from different populations would react to the paradigms. Second, children begin to develop an understanding of normativity around the age of 3 years (Rakoczy et al., 2008). With regard to this finding, it seems likely that children's developing understanding of social norms also influences their decisions about lying. According to Lee (2013), lying is affected by the specific social context and culture in which it occurs.

Thus, children may behave differently in the same social context in a different culture. Future research should systematically investigate cross-cultural variation, and the methods used in this thesis should be imported to non-WEIRD populations. For instance, spontaneous lying for prosocial purposes without personal benefit may occur earlier in collectivistic than in individualistic cultures. On the other hand, children in collectivistic cultures may lie less to enhance their reputation, as honesty and modesty seem to be important factors for the functioning of collective societies.

The experimental designs presented in this dissertation simulated naturalistic settings focusing on interactions with puppets (Studies 1-3) or with peers (Study 4). Still, interacting with puppets or pre-recorded videos is different in many aspects from directly interacting with other peers or adults, and we do not know whether the same processes occur in both contexts. However, puppet paradigms and pre-recorded videos avoid potential confounds, such as an authority bias, facial expressions, or body postures, which could affect children's lying in interactive studies with other children or adults. They eliminate extraneous cues, and the social situation becomes simpler and more decipherable to a child vis-à-vis phenomenon of interest to research. On the other hand, this might change the meaning of the social and cultural situation. Moreover, the interaction-based paradigms presented in this thesis might be only a suitable method for children who are used to playing with puppets in their cultural context. Taken together, ecological validity and contextual generalizability of the experimental methods used in this thesis remain a topic of debate. According to Kominsky et al. (2020), it is a common challenge to design stimuli that contain construct-relevant information with as few confounding features as possible, and we may often face a trade-off between internal and ecological validity (Kominsky et al., 2020). Research on

the relation between simulated situations and children's everyday lives might be crucial to extending our understanding of children's development outside of simulated and experimentally-controlled situations.

Another important issue is that interactive studies with puppets require sophisticated acting from the experimenter, making them relatively difficult to replicate. Moreover, in Studies 1-3, the same omniscient experimenter acted out all the puppets. In this regard, an open question is how children perceive the experimenter in that situation. Do they attribute beliefs or mental states to the experimenter? In the puppet play, children may represent three different perspectives simultaneously: Their own perspective, the puppet's perspective, and the experimenter's objective perspective. Although children's perspective tracking may be an automatic process, the experimenter's omniscient perspective still might have affected their ability to contrast the different perspectives. This may be different from a design in which the puppets are acted out by different experimenters who then, as do the puppets, have different epistemic states. Another option to avoid influences of the experimenter's knowledge may be to occlude her behind a one-way screen with a hole in it, through which she can interact with the child. Alternatively, it might be that in the interaction-based puppet paradigms, the experimenter is just not in the child's focus of attention. Future research should address this issue.

7.2.2. Influencing factors

Another farther-reaching question that emerged from the results presented in this study is the question of the social and cognitive correlates that underlie spontaneous lying. In order to answer this question, Study 1 focused on ToM and inhibitory control. However, this captures only a small range of cognitive abilities. Other intra-individual

factors, such as temperament or intelligence, may be relevant to the development of lying. This question also relates to the issue of cultural and societal values posed above. For instance, children's lying may be related to what their parents teach them about lying (Lavoie et al., 2016). More research on this topic needs to be undertaken before the association between the development of lying and its underlying social and cognitive factors is more clearly understood.

7.2.3. Explicit reasoning

One question that remains from Study 3 is whether children at a younger age also spontaneously adapt their lying to the recipient's epistemic state in social interactions with others and whether children are able to explicitly reason about the selective relevance of their lying. Research suggests that the ability to explicitly reason about the selective relevance of their truthful information does not emerge before the age of 7 years when children are able to efficiently identify and communicate what is most important for a recipient and consider to whom a piece of information is most relevant (Danovitch, 2020). To investigate whether children are able to explicitly reason about the relevance of their misinforming communication based on the recipient's level of knowledge, we tested 5-year-old children in an explicit, third-person version of the interactive paradigm used in Study 3. In this version, children were presented with a story about two agents (protagonist and antagonist). The experimenter then asked the child what the protagonist should do next, including analogous response alternatives for the interaction-based version. Preliminary results suggest that 5-year-olds recommend actions based on the mental states of a third person but a full discussion of the study is beyond the limits of this thesis.

7.3. Practical implications

The findings from this thesis make several contributions to the current literature on children's understanding and manipulation of others' minds. They may help to better understand the developmental origins of lying as well as the underlying motivational and conceptual processes. Thus, the results may increase the social awareness of lying as a normative and uniquely human behavior. Although lying is a natural human behavior, it is occasionally maladaptive and can develop into problematic behavior when it harms social relationships (e.g., by preventing children from building friendships or when it harms the child) (Talwar & Crossman, 2011). For instance, research suggests that maltreated children are more likely to conceal something because they may fear the consequences of their disclosure (Shields et al., 2001; Shipman & Zeman, 2001). This emphasizes the importance of early interventions and interviewing techniques, which encourage children's honesty and uncover the truth without undermining the quality and credibility of children's reports. Providing insights into the cognitive and motivational foundation of children's lying, the findings of this thesis may serve as the basis for the development of early interventions and truth induction strategies, which encourage children's honesty. Thus, practical implications of the current research mainly address legal, clinical, and educational settings.

On the other hand, research suggests that autistic children have deficits in understanding and manipulating others' minds (Baron-Cohen et al., 1985). For instance, they fail at lying to an agent and implanting false beliefs, even in simple deception tasks (Sodian & Frith, 1992). Thus, an abnormal development of lying (e.g., characterized by its total absence) may be indicative of autism spectrum disorders. Further practical implications of this dissertation may address efforts to teach and train the understanding

of others' beliefs in autistic children. In summary, this dissertation contributes to a deeper understanding of the origins and developmental pathways of lying.

7.4. Concluding remarks

Infants communicate with an understanding of others' minds early on and use this understanding to align and exchange perspectives in joint attentional interactions with others. In their first year of life, for instance, they align their attention and perspective with others via referential communication (e.g., offering, showing, or pointing to an object), with the goal of getting the recipient attend to what the communicator is already attending to (Tomasello, 1998). In joint attentional interactions, they share a focus on something but simultaneously understand that they both have an individual perspective on the same thing (Moll & Tomasello, 2007; Tomasello, 2008, 2018). It is likely that, through accumulating social-interactive experiences across the next two years, children become increasingly sensitive to the subjective perspectives of others. In particular, perspective-shifting linguistic discourse supports children's ability to distinguish between different perspectives (Tomasello, 2019). Around age 3, children develop the skills to understand conflicting perspectives. For instance, they become able to coordinate different mental perspectives that seem to be incompatible in an objective situation. As findings from this dissertation suggest, it is also around the age of 3 years that children begin to develop skills to actively and spontaneously manipulate others' mental perspectives to be different from their own (and objective) perspectives.

The motivation to engage in cooperative communication may be a result of the evolutionary pressure for collaborative foraging. At some point in human evolution, individuals were forced to collaborate to obtain food and survive (Tomasello, 2020).

Thus, partner choice for good collaborators became an essential process of social selection. Individuals assessed one another and were ambitious to establish a cooperative identity in the eyes of potential partners. In addition to cooperative communication, false communication has presumably evolved under natural selection. From an evolutionary perspective, lying can be advantageous in some situations, for instance, when providing social harmony or when managing one's reputation to be a cooperative partner. Yet, dishonesty can become disadvantageous when it results in a loss of credibility and jeopardizes successful collaboration. The challenge to maintain a cooperative and credible identity for the potential collaborative partner and oneself thus requires complex cognitive abilities including the coordination and contrasting of different perspectives. Interestingly, the evolutionary adaptation for aligning and exchanging perspectives with others parallels the ontogenetical pathway from joint attention to the coordination of different perspectives (Tomasello, 2019).

While constructivist theories on development would suggest that children construct their ability to lie in an active learning process (Piaget, 1959), sociocultural approaches would argue that higher cognitive functions such as ability to manipulate others' mental states, are the result of sociocultural experiences (Vygotsky, 1978). Indeed, a variety of research suggests that the development of lying cannot be understood without reference to the social and cultural context in which it is embedded (e.g., Seiter et al., 2002). The findings of this thesis support the interpretation that mature human forms of communication and mindreading emerge ontogenetically through a process of social co-construction. Thus, the child constructs the ability to lie on an executive level from her social interactive experiences with others (Tomasello, 2019), likely through coordinating (conflicting) perspectives.

References

Ahn, S., Amemiya, J., Compton, B. J., & Heyman, G. D. (2020). Children approve of lying to benefit another person's reputation. *Cognitive Development*, *56*, 100960. https://doi.org/10.1016/j.cogdev.2020.100960

Allen, J. W. P., & Lewis, M. (2020). Who peeks: Cognitive, emotional, behavioral, socialization, and child correlates of preschoolers' resistance to temptation. *European Journal of Developmental Psychology*, *17*(4), 481–503.

Amemiya, J., Liu, Z., Compton, B. J., & Heyman, G. D. (2020). Children's judgements of positive claims people make about themselves. *Infant and Child Development*, e2212. https://doi.org/10.1002/icd.2212

Apperly, I. A., & Butterfill, S. A. (2009). Do humans have two systems to track beliefs and belief-like states? *Psychological Review*, *116*(4), 953–970. https://doi.org/10.1037/a0016923

Baillargeon, R., Buttelmann, D., & Southgate, V. (2018). Invited Commentary: Interpreting failed replications of early false-belief findings: Methodological and theoretical considerations. *Cognitive Development*, *46*, 112–124. https://doi.org/10.1016/j.cogdev.2018.06.001

Baillargeon, R., Scott, R. M., & He, Z. (2010). False-belief understanding in infants. *Trends in Cognitive Sciences*, *14*(3), 110–118. https://doi.org/10/c9qntv

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a "theory of mind" ? *Cognition*, *21*(1), 37–46. https://doi.org/10/c2nhzk

Barr, D. J., & Keysar, B. (2005). Mindreading in an Exotic Case: The Normal Adult Human. In *Other minds: How humans bridge the divide between self and others* (pp. 271–283). Guilford Press.

Baumrind, D. (1971). Current patterns of parental authority. *Developmental Psychology*, *4*(1, Pt.2), 1–103. https://doi.org/10.1037/h0030372

Bigelow, A. E., & Dugas, K. (2009). Relations Among Preschool Children's Understanding of Visual Perspective Taking, False Belief, and Lying. *Journal of Cognition and Development*, *9*(4), 411–433. https://doi.org/10/cr38jc

Bloom, P., & German, T. P. (2000). Two reasons to abandon the false belief task as a test of theory of mind. *Cognition*, *77*(1), 25–31. https://doi.org/10/bnpr7k

Bond, C. F., & Robinson, M. (1988). The evolution of deception. *Iournal of Nonverbal Behavior*, *12*(4), 295–307. https://doi.org/10/d38zdt

Bottoms, B. L., Goodman, G. S., Schwartz-Kenney, B. M., & Thomas, S. N. (2002). Understanding Children's Use of Secrecy in the Context of Eyewitness Reports. *Law and Human Behavior*, *26*(3), 285–313. https://doi.org/10/c4dfs9

Bronfenbrenner, U. (1977). Toward an experimental ecology of human development. *American Psychologist*, *32*(7), 513–531. https://doi.org/10.1037/0003-066X.32.7.513

Bussey, K. (1999). Children's Categorization and Evaluation of Different Types of Lies and Truths. *Child Development*, *70*(6), 1338–1347. https://doi.org/10/dr5d39

Buttelmann, D., Carpenter, M., & Tomasello, M. (2009). Eighteen-month-old infants show false belief understanding in an active helping paradigm. *Cognition*, *112*(2), 337–342. https://doi.org/10/cv6x5b

Buttelmann, D., Over, H., Carpenter, M., & Tomasello, M. (2014). Eighteen-month-olds understand false beliefs in an unexpected-contents task. *Journal of*

Experimental Child Psychology, *119*, 120–126. https://doi.org/10.1016/j.jecp.2013.10.002

Buttelmann, F., Suhrke, J., & Buttelmann, D. (2015). What you get is what you believe: Eighteen-month-olds demonstrate belief understanding in an unexpected-identity task. *Journal of Experimental Child Psychology*, *131*, 94–103. https://doi.org/10.1016/j.jecp.2014.11.009

Carlson, S. M., & Moses, L. J. (2001). Individual Differences in Inhibitory Control and Children's Theory of Mind. *Child Development*, *72*(4), 1032–1053. https://doi.org/10/dfpng3

Carlson, S. M., Moses, L. J., & Hix, H. R. (1998). The Role of Inhibitory Processes in Young Children's Difficulties with Deception and False Belief. *Child Development*, *69*(3), 672–691. https://doi.org/10/b5n3df

Carpenter, M., Call, J., & Tomasello, M. (2002). A new false belief test for 36-month-olds. *British Journal of Developmental Psychology*, *20*(3), 393–420. https://doi.org/10.1348/026151002320620316

Chandler, M., Fritz, A. S., & Hala, S. (1989). Small-Scale Deceit: Deception as a Marker of Two-, Three-, and Four-Year-Olds' Early Theories of Mind. *Child Development*, *60*(6), 1263–1277. https://doi.org/10/fp3hn6

Corriveau, K., & Harris, P. L. (2009). Choosing your informant: Weighing familiarity and recent accuracy. *Developmental Science*, *12*(3), 426–437. https://doi.org/10/bwssfs

Couillard, N. L., & Woodward, A. L. (1999). Children's comprehension of deceptive points. *British Journal of Developmental Psychology*, *17*(4), 515–521. https://doi.org/10/crtm8z

Crivello, C., & Poulin-Dubois, D. (2018). Infants' false belief understanding: A non-replication of the helping task. *Cognitive Development*, *46*, 51–57. https://doi.org/10.1016/j.cogdev.2017.10.003

Danovitch, J. H. (2020). Children's selective information sharing based on the recipient's role. *The Journal of Genetic Psychology*, *181*(2–3), 68–77. https://doi.org/10.1080/00221325.2020.1712319

Davoodi, T., Corriveau, K. H., & Harris, P. L. (2016). Distinguishing between realistic and fantastical figures in Iran. *Developmental Psychology*, *52*(2), 221–231. https://doi.org/10.1037/dev0000079

Debey, E., Schryver, M., Logan, G. D., Suchotzki, K., & Verschuere, B. (2015). From junior to senior Pinocchio: A cross-sectional lifespan investigation of deception. *Acta Psychologica*, *160*, 58–68. https://doi.org/10/f7r2c5

Dennett, D. C. (1978). Beliefs about beliefs. *Behavioral and Brain Sciences*, *1*(4), 568–570. https://doi.org/10/cfzp8g

DePaulo, B. M., Kashy, D. A., Kirkendol, S. E., & Epstein, J. A. (1996). Lying in Everyday Life. *Journal of Personality and Social Psychology*, *70*(5), 979–995. https://doi.org/10/dm2g54

Ding, X. P., Heyman, G. D., Fu, G., Zhu, B., & Lee, K. (2018). Young children discover how to deceive in 10 days: A microgenetic study. *Developmental Science*, *21*(3), e12566. https://doi.org/10/gdd9m5

Ding, X. P., Heyman, G. D., Sai, L., Yuan, F., Winkielman, P., Fu, G., & Lee, K. (2018). Learning to deceive has cognitive benefits. *Journal of Experimental Child Psychology*, *176*, 26–38. https://doi.org/10/gfzfdn

Ding, X. P., Teo, S. L. Y., & Tay, C. (2021). The link between parental mental state talk and children's lying: An indirect effect via false belief understanding. *Journal of Experimental Child Psychology*, *201*, 104990. https://doi.org/10.1016/j.jecp.2020.104990

Ding, X. P., Wellman, H. M., Wang, Y., Fu, G., & Lee, K. (2015). Theory-of-Mind Training Causes Honest Young Children to Lie. *Psychological Science*, *26*(11), 1812–1821. https://doi.org/10/f7zbjz

Dörrenberg, S., Rakoczy, H., & Liszkowski, U. (2018). How (not) to measure infant Theory of Mind: Testing the replicability and validity of four non-verbal measures. *Cognitive Development*, *46*, 12–30. https://doi.org/10/gd5nx7

Dörrenberg, S., Wenzel, L., Proft, M., Rakoczy, H., & Liszkowski, U. (2019). Reliability and generalizability of an acted-out false belief task in 3-year-olds. *Infant Behavior and Development*, *54*, 13–21. https://doi.org/10.1016/j.infbeh.2018.11.005

Engelmann, J. M., Herrmann, E., & Tomasello, M. (2012). Five-year olds, but not chimpanzees, attempt to manage their reputations. *PloS One*, *7*(10), 48433. https://doi.org/10/f4ccwt

Engelmann, J. M., Over, H., Herrmann, E., & Tomasello, M. (2013). Young children care more about their reputation with ingroup members and potential reciprocators. *Developmental Science*, *16*(6), 952–958. https://doi.org/10/gbdxsr

Engelmann, J. M., & Rapp, D. J. (2018). The influence of reputational concerns on children's prosociality. *Current Opinion in Psychology*, *20*, 92–95. https://doi.org/10/gfzffd

Eskritt, M., & Lee, K. (2017). The Detection of Prosocial Lying by Children. *Infant and Child Development*, *26*(1), 1969. https://doi.org/10/gfzfd8

Evans, A. D., & Lee, K. (2011). Verbal deception from late childhood to middle adolescence and its relation to executive functioning skills. *Developmental Psychology*, *47*(4), 1108–1116.

Evans, A. D., & Lee, K. (2013). Emergence of lying in very young children. *Developmental Psychology*, *49*(10), 1958–1963. https://doi.org/10/f5c3dm

Evans, A. D., Xu, F., & Lee, K. (2011). When all signs point to you: Lies told in the face of evidence. *Developmental Psychology*, *47*(1), 39–49. https://doi.org/10/d4kqxs

Flavell, J. H., Green, F. L., Flavell, E. R., & Lin, N. T. (1999). Development of Children's Knowledge about Unconsciousness. *Child Development*, *70*(2), 396–412. https://doi.org/10/cw88z7

Frick, P. J. (1991). *The Alabama Parenting Questionnaire. Unpublished Instrument. Alabama: University of Alabama, Department of Psychology.*

Friedman, O., & Petrashek, A. R. (2009). Children do not follow the rule "ignorance means getting it wrong." *Journal of Experimental Child Psychology*, *102*(1), 114–121. https://doi.org/10/d3svhz

Fritzley, V. H., & Lee, K. (2003). Do Young Children Always Say Yes to Yes–No Questions? A Metadevelopmental Study of the Affirmation Bias. *Child Development*, *74*(5), 1297–1313. https://doi.org/10.1111/1467-8624.00608

Fu, G., Evans, A. D., Wang, L., & Lee, K. (2008). Lying in the name of the collective good: A developmental study. *Developmental Science*, *11*(4), 495–503. https://doi.org/10.1111/j.1467-7687.2008.00695.x

Fu, G., Evans, A. D., Xu, F., & Lee, K. (2012). Young children can tell strategic lies after committing a transgression. *Journal of Experimental Child Psychology*, *113*(1), 147–158. https://doi.org/10/f336zx

Fu, G., Heyman, G. D., Qian, M., Guo, T., & Lee, K. (2016). Young children with a positive reputation to maintain are less likely to cheat. *Developmental Science*, *19*(2), 275–283. https://doi.org/10/f79h7d

German, T. P., & Leslie, A. M. (2001). Children's inferences from 'knowing' to 'pretending' and 'believing.' *British Journal of Developmental Psychology*, *19*(1), 59–83. https://doi.org/10/bvw7np

Gongola, J., Scurich, N., & Quas, J. A. (2017). Detecting deception in children: A meta-analysis. *Law and Human Behavior*, *41*(1), 44–54. https://doi.org/10/gfzfc7

Hala, S., & Russell, J. (2001). Executive control within strategic deception: A window on early cognitive development? *Journal of Experimental Child Psychology*, *80*(2), 112–141. https://doi.org/10/fs7kj5

Hamlin, J. K. (2013). Moral Judgment and Action in Preverbal Infants and Toddlers: Evidence for an Innate Moral Core. *Current Directions in Psychological Science*, *22*(3), 186–193. https://doi.org/10.1177/0963721412470687

Hamlin, J. K., Wynn, K., & Bloom, P. (2007). Social evaluation by preverbal infants. *Nature*, *450*(7169), 557–559. https://doi.org/10.1038/nature06288

Harvey, T., Davoodi, T., & Blake, P. R. (2018). Young children will lie to prevent a moral transgression. *Journal of Experimental Child Psychology*, *165*, 51–65. https://doi.org/10/gfzfft

Hayashi, H. (2017). Young children's difficulty with deception in a conflict situation. *International Journal of Behavioral Development*, *41*(2), 175–184. https://doi.org/10/f97vx4

Heinrich, M., & Liszkowski, U. (2021). Three-year-olds' spontaneous lying in a novel interaction-based paradigm and its relations to explicit skills and motivational factors. *Journal of Experimental Child Psychology*, *207*, 105125. https://doi.org/10.1016/j.jecp.2021.105125

Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences*, *33*(2–3), 61–83. https://doi.org/10.1017/S0140525X0999152X

Hermansen, T. K., Ronfard, S., Harris, P. L., Pons, F., & Zambrana, I. M. (2021). Young children update their trust in an informant's claim when experience tells them otherwise. *Journal of Experimental Child Psychology*, *205*, 105063. https://doi.org/10.1016/j.jecp.2020.105063

Herrmann, E., Engelmann, J. M., & Tomasello, M. (2019). Children engage in competitive altruism. *Journal of Experimental Child Psychology*, *179*, 176–189. https://doi.org/10/gfzfc2

Heyman, G., Barner, D., Heumann, J., & Schenck, L. (2014). Children's sensitivity to ulterior motives when evaluating prosocial behavior. *Cognitive Science*, *38*(4), 683–700. https://doi.org/10/f562vb

Heyman, G. D., Sritanyaratana, L., & Vanderbilt, K. E. (2013). Young children's trust in overtly misleading advice. *Cognitive Science*, *37*(4), 646–667. https://doi.org/10/f4wkf6

Heyman, G. D., Sweet, M. A., & Lee, K. (2009). Children's Reasoning about Lie-telling and Truth-telling in Politeness Contexts. *Social Development*, *18*(3), 728–746. https://doi.org/10/cf7wh3

Hofer, T., & Aschersleben, G. (2007). *Theory of Mind-Skala für 3- bis 5-jährige Kinder* (3rd ed.). Max-Planck-Institut für Kognitions- und Neurowissenschaften.

Hulme, S., Mitchell, P., & Wood, D. (2003). Six-year-olds' difficulties handling intensional contexts. *Cognition*, *87*(2), 73–99. https://doi.org/10/d7rjs4

Jaswal, V. K. (2010). Believing what you're told: Young children's trust in unexpected testimony about the physical world. *Cognitive Psychology*, *61*(3), 248–272. https://doi.org/10/cgh26m

Jaswal, V. K., & Malone, L. S. (2007). Turning Believers into Skeptics: 3-Year-Olds' Sensitivity to Cues to Speaker Credibility. *Journal of Cognition and Development*, *8*(3), 263–283. https://doi.org/10/fcvfrq

Karim, A. A., Schneider, M., Lotze, M., Veit, R., Sauseng, P., Braun, C., & Birbaumer, N. (2010). The Truth about Lying: Inhibition of the Anterior Prefrontal Cortex Improves Deceptive Behavior. *Cerebral Cortex*, *20*(1), 205–213. https://doi.org/10.1093/cercor/bhp090

Kelsey, C., Grossmann, T., & Vaish, A. (2018). Early Reputation Management: Three-Year-Old Children Are More Generous Following Exposure to Eyes. *Frontiers in Psychology*, *9*, 698. https://doi.org/10.3389/fpsyg.2018.00698

Király, I., Oláh, K., Csibra, G., & Kovács, Á. M. (2018). Retrospective attribution of false beliefs in 3-year-old children. *Proceedings of the National Academy of Sciences*, *115*(45), 11477–11482. https://doi.org/10/gfnzhk

Knudsen, B., & Liszkowski, U. (2012a). 18-Month-Olds Predict Specific Action Mistakes Through Attribution of False Belief, Not Ignorance, and Intervene Accordingly. *Infancy*, *17*(6), 672–691. https://doi.org/10/bqsfs9

Knudsen, B., & Liszkowski, U. (2012b). Eighteen- and 24-month-old infants correct others in anticipation of action mistakes. *Developmental Science*, *15*(1), 113–122. https://doi.org/10/df4b38

Knudsen, B., & Liszkowski, U. (2013). One-Year-Olds Warn Others About Negative Action Outcomes. *Journal of Cognition and Development*, *14*(3), 424–436. https://doi.org/10/gfzfdv

Kochanska, G., Murray, K., Jacques, T. Y., Koenig, A. L., & Vandegeest, K. A. (1996). Inhibitory Control in Young Children and Its Role in Emerging Internalization. *Child Development*, *67*(2), 490–507. https://doi.org/10/b3q5jf

Kominsky, J. F., Lucca, K., Thomas, A. J., Frank, M. C., & Hamlin, K. (2020). *Simplicity and validity in infant research*. https://doi.org/10.31234/osf.io/6j9p3

Kupfer, J. (1982). The Moral Presumption against Lying. *The Review of Metaphysics*, *36*(1), 103–126.

Lavoie, J., Leduc, K., Arruda, C., Crossman, A., & Talwar, V. (2017). Developmental profiles of children's spontaneous lie-telling behavior. *Cognitive Development*, *41*, 33–45. https://doi.org/10/f9tkvj

Lavoie, J., Leduc, K., Crossman, A. M., & Talwar, V. (2016). Do As I Say and Not As I Think: Parent Socialisation of Lie-Telling Behaviour. *Children & Society*, *30*(4), 253–264. https://doi.org/10/f82984

Lavoie, J., Nagar, P. M., & Talwar, V. (2017). From Kantian to Machiavellian deceivers: Development of children's reasoning and self-reported use of secrets and lies. *Childhood*, *24*(2), 197–211. https://doi.org/10/f97vnf

Lavoie, J., Wyman, J., Crossman, A. M., & Talwar, V. (2018). Lie-telling as a mode of antisocial action: Children's lies and behavior problems. *Journal of Moral Education*, 1–19. https://doi.org/10/gfkhmn

Lavoie, J., Yachison, S., Crossman, A., & Talwar, V. (2017). Polite, instrumental, and dual liars. *International Journal of Behavioral Development*, *41*(2), 257–264. https://doi.org/10/f98k7s

Leduc, K., Williams, S., Gomez-Garibello, C., & Talwar, V. (2017). The contributions of mental state understanding and executive functioning to preschool-aged children's lie-telling. *The British Journal of Developmental Psychology*, *35*(2), 288–302. https://doi.org/10/gfzfd5

Lee, J. Y. S., & Imuta, K. (2021). Lying and Theory of Mind: A Meta-Analysis. *Child Development*, 1–18. https://doi.org/10.1111/cdev.13535

Lee, K. (2013). Little Liars: Development of Verbal Deception in Children. *Child Development Perspectives*, *7*(2), 91–96. https://doi.org/10/f4xkcg

Leimgruber, K. L., Shaw, A., Santos, L. R., & Olson, K. R. (2012). Young Children Are More Generous When Others Are Aware of Their Actions. *PLoS ONE*, *7*(10), e48292. https://doi.org/10.1371/journal.pone.0048292

Leslie, A. M. (1994). Pretending and believing: Issues in the theory of ToMM. *Cognition*, *50*(1–3), 211–238. https://doi.org/10.1016/0010-0277(94)90029-9

Lewis, M. (2015). The Origins of Lying and Deception in Everyday Life. *American Scientist*, *103*(2), 128–135. https://doi.org/10/gfzffg

Lewis, M., Stanger, C., & Sullivan, M. W. (1989). Deception in 3-year-olds. *Developmental Psychology*, *25*(3), 439–443. https://doi.org/10/dbfjt4

Li, A. S., Kelley, E. A., Evans, A. D., & Lee, K. (2011). Exploring the Ability to Deceive in Children with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders*, *41*(2), 185–195. https://doi.org/10.1007/s10803-010-1045-4

Li, Q., Zhang, W., Heyman, G. D., Compton, B. J., & Lee, K. (2020). Susceptibility to Being Lured Away by a Stranger: A Real-World Field Test of Selective Trust in Early Childhood. *Psychological Science*, *31*(12), 1488–1496. https://doi.org/10.1177/0956797620966526

Liszkowski, U. (2013). Using Theory of Mind. *Child Development Perspectives*, *7*(2), 104–109. https://doi.org/10/f4xkjw

Liszkowski, U. (2018). Emergence of shared reference and shared minds in infancy. *Current Opinion in Psychology*, *23*, 26–29. https://doi.org/10/gfzfdd

Liszkowski, U., Carpenter, M., Striano, T., & Tomasello, M. (2006). 12- and 18-Month-Olds Point to Provide Information for Others. *Journal of Cognition and Development*, *7*(2), 173–187. https://doi.org/10/dznj5m

Liszkowski, U., Carpenter, M., & Tomasello, M. (2007). Pointing out new news, old news, and absent referents at 12 months of age. *Developmental Science*, *10*(2), 1–7. https://doi.org/10/fhkbg9

Liszkowski, U., Carpenter, M., & Tomasello, M. (2008). Twelve-month-olds communicate helpfully and appropriately for knowledgeable and ignorant partners. *Cognition*, *108*(3), 732–739. https://doi.org/10/dzvsgd

Low, J., Apperly, I. A., Butterfill, S. A., & Rakoczy, H. (2016). Cognitive Architecture of Belief Reasoning in Children and Adults: A Primer on the Two-Systems Account. *Child Development Perspectives*, *10*(3), 184–189. https://doi.org/10.1111/cdep.12183

Ma, F., Evans, A. D., Liu, Y., Luo, X., & Xu, F. (2015). To lie or not to lie? The influence of parenting and theory-of-mind understanding on three-year-old children's honesty. *Journal of Moral Education*, *43*, 1–15. https://doi.org/10/gfzffn

Ma, F., Zeng, D., Xu, F., Compton, B. J., & Heyman, G. D. (2020). Delay of Gratification as Reputation Management. *Psychological Science*, *31*(9), 1174–1182. https://doi.org/10.1177/0956797620939940

Maggian, V., & Villeval, M. C. (2016). Social preferences and lying aversion in children. *Experimental Economics*, *19*(3), 663–685. https://doi.org/10/f84csx

Mahon, J. E. (2008). Two Definitions of Lying. *International Journal of Applied Philosophy*, *22*(2), 211–230. https://doi.org/10/fz5kbg

Mascaro, O., Morin, O., & Sperber, D. (2016). Optimistic expectations about communication explain children's difficulties in hiding, lying, and mistrusting liars. *Journal of Child Language*, *44*(5), 1041–1064. https://doi.org/10/gbtk4f

Mascaro, O., & Sperber, D. (2009). The moral, epistemic, and mindreading components of children's vigilance towards deception. *Cognition*, *112*(3), 367–380. https://doi.org/10/chqd3n

Misch, A., Over, H., & Carpenter, M. (2016). I won't tell: Young children show loyalty to their group by keeping group secrets. *Journal of Experimental Child Psychology*, *142*, 96–106. https://doi.org/10/gfzfdh

Misch, A., Over, H., & Carpenter, M. (2018). The Whistleblower's Dilemma in Young Children: When Loyalty Trumps Other Moral Concerns. *Frontiers in Psychology*, *9*, 250. https://doi.org/10/gfzsfm

Mojdehi, A. S., Shohoudi, A., & Talwar, V. (2020). Children's moral evaluations of different types of lies and parenting practices and across cultural contexts. *Current Psychology*, 1–14. https://doi.org/10.1007/s12144-020-01059-7

Moll, H., Kane, S., & McGowan, L. (2016). Three-year-olds express suspense when an agent approaches a scene with a false belief. *Developmental Science*, *19*(2), 208–220. https://doi.org/10/gfzffm

Moll, H., Koring, C., Carpenter, M., & Tomasello, M. (2006). Infants Determine Others' Focus of Attention by Pragmatics and Exclusion. *Journal of Cognition and Development*, *7*(3), 411–430. https://doi.org/10.1207/s15327647jcd0703_9

Moll, H., & Meltzoff, A. N. (2011). How does it look? Level 2 perspective-taking at 36 months of age. *Child Development*, *82*(2), 661–673. https://doi.org/10/c59bp4

Moll, H., Meltzoff, A. N., Merzsch, K., & Tomasello, M. (2013). Taking versus confronting visual perspectives in preschool children. *Developmental Psychology*, *49*(4), 646–654. https://doi.org/10.1037/a0028633

Moll, H., & Tomasello, M. (2006). Level 1 perspective-taking at 24 months of age. *British Journal of Developmental Psychology*, *24*(3), 603–613. https://doi.org/10.1348/026151005X55370

Moll, H., & Tomasello, M. (2007). How 14- and 18-month-olds know what others have experienced. *Developmental Psychology*, *43*(2), 309–317. https://doi.org/10.1037/0012-1649.43.2.309

Moses, L. J. (2001). Executive Accounts of Theory-of-Mind Development. *Child Development*, *72*(3), 688–690. https://doi.org/10.1111/1467-8624.00306

Nagar, P. M., Williams, S., & Talwar, V. (2019). The influence of an older sibling on preschoolers' lie-telling behavior. *Social Development*, *28*(4). https://doi.org/10.1111/sode.12367

Newton, P., Reddy, V., & Bull, R. (2000). Children's everyday deception and performance on false-belief tasks. *British Journal of Developmental Psychology*, *18*(2), 297–317. https://doi.org/10/cjmdwf

O'Connor, A. M., Dykstra, V. W., & Evans, A. D. (2020). Executive functions and young children's lie-telling and lie maintenance. *Developmental Psychology*, *56*(7), 1278. https://doi.org/10.1037/dev0000955

O'Connor, A. M., Lyon, T. D., & Evans, A. D. (2019). Younger and older adults' lie-detection and credibility judgments of children's coached reports. *Psychology, Crime & Law*, *25*(9), 925–944. https://doi.org/10/gf2gpn

O'Neill, D. K. (1996). Two-Year-Old Children's Sensitivity to a Parent's Knowledge State When Making Requests. *Child Development*, *67*(2), 659–677. https://doi.org/10/fw3vwn

Perner, J. (1991). *Understanding the representational mind*. The MIT Press.

Perner, J., Leekam, S. R., & Wimmer, H. (1987). Three-year-olds' difficulty with false belief: The case for a conceptual deficit. *British Journal of Developmental Psychology*, *5*(2), 125–137. https://doi.org/10/b3q3f6

Perner, J., & Roessler, J. (2012). From infants' to children's appreciation of belief. *Trends in Cognitive Sciences*, *16*(10), 519–525. https://doi.org/10.1016/j.tics.2012.08.004

Perner, J., & Ruffman, T. (2005). Infants' Insight into the Mind: How Deep? *Science*, *308*(5719), 214–216.

Perner, J., & Wimmer, H. (1985). "John thinks that Mary thinks that…" attribution of second-order beliefs by 5- to 10-year-old children. *Journal of Experimental Child Psychology*, *39*(3), 437–471. https://doi.org/10/dgb5qm

Peskin, J. (1992). Ruse and representations: On children's ability to conceal information. *Developmental Psychology*, *28*(1), 84–89. https://doi.org/10/djkgrn

Piaget, J. (1932). *The moral judgment of the child*. New York: Free Press.

Piaget, J. (1959). *The Language and Thought of the Child* (5th ed.). Psychology Press.

Pipe, M.-E., & Wilson, J. C. (1994). Cues and secrets: Influences on children's event reports. *Developmental Psychology*, *30*(4), 515–525. https://doi.org/10/crdc2n

Polak, A., & Harris, P. L. (1999). Deception by young children following noncompliance. *Developmental Psychology*, *35*(2), 561–568. https://doi.org/10/cpq44f

Popliger, M., Talwar, V., & Crossman, A. (2011). Predictors of children's prosocial lie-telling: Motivation, socialization variables, and moral understanding. *Journal of Experimental Child Psychology*, *110*(3), 373–392. https://doi.org/10/b9r38q

Poulin-Dubois, D., Rakoczy, H., Burnside, K., Crivello, C., Dörrenberg, S., Edwards, K., Krist, H., Kulke, L., Liszkowski, U., Low, J., Perner, J., Powell, L.,

Priewasser, B., Rafetseder, E., & Ruffman, T. (2018). Do infants understand false beliefs? We don't know yet – A commentary on Baillargeon, Buttelmann and Southgate's commentary. *Cognitive Development*, *48*, 302–315. https://doi.org/10.1016/j.cogdev.2018.09.005

Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences*, *1*, 515–526. https://doi.org/10/ddvt4n

Priewasser, B., Rafetseder, E., Gargitter, C., & Perner, J. (2018). Helping as an early indicator of a theory of mind: Mentalism or Teleology? *Cognitive Development*, *46*, 69–78. https://doi.org/10/gd5n4d

Rakoczy, H. (2012). Do infants have a theory of mind? *British Journal of Developmental Psychology*, *30*(1), 59–74. https://doi.org/10.1111/j.2044-835X.2011.02061.x

Rakoczy, H., Warneken, F., & Tomasello, M. (2008). The sources of normativity: Young children's awareness of the normative structure of games. *Developmental Psychology*, *44*(3), 875–881. https://doi.org/10/br6p85

Rapp, D. J., Engelmann, J. M., Herrmann, E., & Tomasello, M. (2019). Young children's reputational strategies in a peer group context. *Developmental Psychology*, *55*(2), 329–336. https://doi.org/10/gfzffv

Reed, M. A., Pien, D. L., & Rothbart, M. K. (1984). Inhibitory Self-Control in Preschool Children. *Merrill-Palmer Quarterly*, *30*(2), 131–147.

Reichle, B., & Franiek, S. (2009). Erziehungsstil aus Elternsicht. *Zeitschrift Für Entwicklungspsychologie Und Pädagogische Psychologie*, *41*(1), 12–25. https://doi.org/10/c7g9rv

Rhodes, M., & Brandone, A. C. (2014). Three-year-olds' theories of mind in actions and words. *Frontiers in Psychology*, *5*, 263. https://doi.org/10/gfzffq

Rittle-Johnson, B., & Siegler, R. S. (1998). The relation between conceptual and procedural knowledge in learning mathematics: A review. In *The development of mathematical skills* (pp. 75–110). Psychology Press/Taylor & Francis (UK).

Rubio-Fernández, P. (2013). Perspective tracking in progress: Do not disturb. *Cognition*, *129*(2), 264–272. https://doi.org/10/f5hn34

Rubio-Fernández, P., & Geurts, B. (2013). How to pass the false-belief task before your fourth birthday. *Psychological Science*, *24*(1), 27–33. https://doi.org/10/gfzfdj

Rubio-Fernández, P., & Geurts, B. (2016). Don't Mention the Marble! The Role of Attentional Processes in False-Belief Tasks. *Review of Philosophy and Psychology*, *7*(4), 835–850. https://doi.org/10/gfzfdc

Ruffman, T. (2014). To belief or not belief: Children's theory of mind. *Developmental Review*, *34*(3), 265–293. https://doi.org/10/f6cv2n

Sabbagh, M. A., Moses, L. J., & Shiverick, S. (2006). Executive Functioning and Preschoolers' Understanding of False Beliefs, False Photographs, and False Signs. *Child Development*, *77*(4), 1034–1049. https://doi.org/10.1111/j.1467-8624.2006.00917.x

Sai, L., Shang, S., Tay, C., Liu, X., Sheng, T., Fu, G., Ding, X. P., & Lee, K. (2021). Theory of Mind, Executive Function, and Lying in Children: A Meta-Analysis. *Developmental Science*, e13096. https://doi.org/10.1111/desc.13096

Sai, L., Zhao, C., Heyman, G. D., Compton, B. J., & Fu, G. (2020). Young children's lying and early mental state understanding. *Infant and Child Development*, e2197. https://doi.org/10.1002/icd.2197

Sarnecka, B. W., & Carey, S. (2008). How Counting Represents Number: What Children Must Learn and When They Learn It. *Cognition*, *108*(3), 662–674. https://doi.org/10.1016/j.cognition.2008.05.007

Schmidt, M. F. H., Rakoczy, H., & Tomasello, M. (2013). Young children understand and defend the entitlements of others. *Journal of Experimental Child Psychology*, *116*(4), 930–944. https://doi.org/10.1016/j.jecp.2013.06.013

Schütte, F., Mani, N., & Behne, T. (2020). Retrospective inferences in selective trust. *Royal Society Open Science*, *7*(2), 191451. https://doi.org/10.1098/rsos.191451

Scott, R. M., & Baillargeon, R. (2017). Early False-Belief Understanding. *Trends in Cognitive Sciences*, *21*(4), 237–249. https://doi.org/10/f9zqv5

Scott, R. M., Richman, J. C., & Baillargeon, R. (2015). Infants understand deceptive intentions to implant false beliefs about identity: New evidence for early mentalistic reasoning. *Cognitive Psychology*, *82*, 32–56. https://doi.org/10/gfzfdp

Seiter, J. S., Bruschke, J., & Bai, C. (2002). The acceptability of deception as a function of perceivers' culture, deceiver's intention, and deceiver-deceived relationship. *Western Journal of Communication*, *66*(2), 158–180. https://doi.org/10/c6z7dm

Shaw, A., DeScioli, P., & Olson, K. R. (2012). Fairness versus favoritism in children. *Evolution and Human Behavior*, *33*(6), 736–745. https://doi.org/10/f4fdwc

Shields, A., Ryan, R. M., & Cicchetti, D. (2001). Narrative representations of caregivers and emotion dysregulation as predictors of maltreated children's rejection by peers. *Developmental Psychology*, *37*(3), 321–337. https://doi.org/10.1037/0012-1649.37.3.321

Shipman, K. L., & Zeman, J. (2001). Socialization of children's emotion regulation in mother–child dyads: A developmental psychopathology perspective. *Development and Psychopathology*, *13*(2), 317–336. https://doi.org/10.1017/S0954579401002073

Sierksma, J., Spaltman, M., & Lansu, T. A. M. (2019). Children Tell More Prosocial Lies in Favor of In-Group Than Out-Group Peers. *Developmental Psychology*, *55*(7), 1428–1439.

Smith, C. E., Blake, P. R., & Harris, P. L. (2013). I Should but I Won't: Why Young Children Endorse Norms of Fair Sharing but Do Not Follow Them. *PLoS ONE*, *8*(3), e59510. https://doi.org/10.1371/journal.pone.0059510

Sodian, B. (1991). The development of deception in young children. *British Journal of Developmental Psychology*, *9*(1), 173–188. https://doi.org/10/fktwmk

Sodian, B., & Frith, U. (1992). Deception and Sabotage in Autistic, Retarded and Normal Children. *Journal of Child Psychology and Psychiatry*, *33*(3), 591–605. https://doi.org/10/d3s972

Sodian, B., Taylor, C., Harris, P. L., & Perner, J. (1991). Early Deception and the Child's Theory of Mind: False Trails and Genuine Markers. *Child Development*, *62*(3), 468–483. https://doi.org/10/ftw8vg

Southgate, V. (2020). Are infants altercentric? The other and the self in early social cognition. *Psychological Review*, *127*(4), 505–523. https://doi.org/10.1037/rev0000182

Southgate, V., Chevallier, C., & Csibra, G. (2010). Seventeen-month-olds appeal to false beliefs to interpret others' referential communication. *Developmental Science*, *13*(6), 907–912. https://doi.org/10/br7gsb

Sperber, D., & Wilson, D. (1995). *Relevance: Communication and cognition* (2nd ed). Blackwell Publishers.

Stengelin, R., Grueneisen, S., & Tomasello, M. (2018). Why should I trust you? Investigating young children's spontaneous mistrust in potential deceivers. *Cognitive Development*, *48*, 146–154. https://doi.org/10/gfs8vv

Stouthamer-Loeber, M. (1986). Lying as a problem behavior in children: A review. *Clinical Psychology Review*, *6*(4), 267–289. https://doi.org/10/d4qdmr

Sullivan, K., & Winner, E. (1991). When 3-year-olds understand ignorance, false belief and representational change. *British Journal of Developmental Psychology*, *9*(1), 159–171. https://doi.org/10/fgrpxs

Talwar, V., & Crossman, A. (2011). From little white lies to filthy liars. *Advances in Child Development and Behavior*, *40*, 139–179. https://doi.org/10.1016/B978-0-12-386491-8.00004-9

Talwar, V., Crossman, A., & Wyman, J. (2017). The role of executive functioning and theory of mind in children's lies for another and for themselves. *Early Childhood Research Quarterly*, *41*, 126–135. https://doi.org/10/gfzffh

Talwar, V., Gordon, H. M., & Lee, K. (2007). Lying in the elementary school years: Verbal deception and its relation to second-order belief understanding. *Developmental Psychology*, *43*(3), 804–810. https://doi.org/10/bgg89q

Talwar, V., Hubbard, K., Saykaly, C., Lee, K., Lindsay, R. C. L., & Bala, N. (2018). Does parental coaching affect children's false reports? Comparing verbal markers of deception. *Behavioral Sciences & the Law*, *36*(1), 84–97. https://doi.org/10/gc322c

Talwar, V., Lavoie, J., & Crossman, A. M. (2019). Carving Pinocchio: Longitudinal examination of children's lying for different goals. *Journal of Experimental Child Psychology*, *181*, 34–55. https://doi.org/10/gf2gkn

Talwar, V., Lavoie, J., Garibello, C. G., & Crossman, A. (2017). Influence of social factors on the relation between lie-telling and children's cognitive abilities. *Journal of Experimental Child Psychology*, *159*, 185–198. https://doi.org/10/f97pcc

Talwar, V., & Lee, K. (2002a). Development of lying to conceal a transgression: Children's control of expressive behaviour during verbal deception. *International Journal of Behavioral Development*, *26*(5), 436–444. https://doi.org/10/cv6dnk

Talwar, V., & Lee, K. (2002b). Emergence of White-Lie Telling in Children Between 3 and 7 Years of Age. *Merrill-Palmer Quarterly*, *48*(2), 160–181. https://doi.org/10/cj2gkk

Talwar, V., & Lee, K. (2008). Social and cognitive correlates of children's lying behavior. *Child Development*, *79*(4), 866–881. https://doi.org/10/fb7qtf

Talwar, V., & Lee, K. (2011). A punitive environment fosters children's dishonesty: A natural experiment. *Child Development*, *82*(6), 1751–1758. https://doi.org/10/chvkxh

Talwar, V., Lee, K., Bala, N., & Lindsay, R. C. L. (2004). Children's Lie-Telling to Conceal a Parent's Transgression: Legal Implications. *Law and Human Behavior*, *28*(4), 411–435. https://doi.org/10/dgnk46

Talwar, V., Murphy, S. M., & Lee, K. (2007). White lie-telling in children for politeness purposes. *International Journal of Behavioral Development*, *31*(1), 1–11. https://doi.org/10/d78gbh

Tomasello, M. (1998). Reference: Intending that others jointly attend. *Pragmatics & Cognition*, *6*(1–2), 229–243. https://doi.org/10.1075/pc.6.1-2.12tom

Tomasello, M. (2008). *Origins of human communication*. MIT Press.

Tomasello, M. (2018). How children come to understand false beliefs: A shared intentionality account. *Proceedings of the National Academy of Sciences of the United States of America*, *115*(34), 8491–8498. https://doi.org/10/gd5xxk

Tomasello, M. (2019). *Becoming Human: A Theory of Ontogeny*. Harvard University Press.

Tomasello, M. (2020). The moral psychology of obligation. *Behavioral and Brain Sciences*, *43*. https://doi.org/10.1017/S0140525X19001742

Varró-Horváth, D. Á., Dorn, K., & Lábadi, B. (2017). Understanding deceptive intentions behind pointing gestures in 12-15-month-old infants. *Infant Behavior & Development*, *47*, 121–124. https://doi.org/10/gfzffr

Vasil, J., Badcock, P. B., Constant, A., Friston, K., & Ramstead, M. J. D. (2020). A World Unto Itself: Human Communication as Active Inference. *Frontiers in Psychology*, *11*. https://doi.org/10.3389/fpsyg.2020.00417

Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.

Walczyk, J. J., Mahoney, K. T., Doverspike, D., & Griffith-Ross, D. A. (2009). Cognitive Lie Detection: Response Time and Consistency of Answers as Cues to Deception. *Journal of Business and Psychology*, *24*(1), 33–49. https://doi.org/10.1007/s10869-009-9090-8

Walczyk, J. J., Roper, K. S., Seemann, E., & Humphrey, A. M. (2003). Cognitive mechanisms underlying lying to questions: Response time as a cue to deception. *Applied Cognitive Psychology*, *17*(7), 755–774. https://doi.org/10.1002/acp.914

Warneken, F., & Orlins, E. (2015). Children tell white lies to make others feel better. *The British Journal of Developmental Psychology*, *33*(3), 259–270. https://doi.org/10/f7m4ns

Warneken, F., & Tomasello, M. (2006). Altruistic Helping in Human Infants and Young Chimpanzees. *Science*, *311*(5765), 1301–1303. https://doi.org/10.1126/science.1121448

Wellman, H. M., Cross, D., & Watson, J. (2001). Meta-Analysis of Theory-of-Mind Development: The Truth about False Belief. *Child Development*, *72*(3), 655–684. https://doi.org/10/css9pc

Wellman, H. M., & Liu, D. (2004a). Scaling of Theory-of-Mind Tasks. *Child Development*, *75*(2), 523–541. https://doi.org/10/c6t3ch

Wellman, H. M., & Liu, D. (2004b). Scaling of theory-of-mind tasks. *Child Development*, *75*(2), 523–541. https://doi.org/10/c6t3ch

Wenzel, L., Dörrenberg, S., Proft, M., Liszkowski, U., & Rakoczy, H. (2020). Actions do not speak louder than words in an interactive false belief task. *Royal Society Open Science*, *7*(10), 191998.

Williams, S., Moore, K., Crossman, A. M., & Talwar, V. (2016). The role of executive functions and theory of mind in children's prosocial lie-telling. *Journal of Experimental Child Psychology*, *141*, 256–266. https://doi.org/10/gfzffj

Wimmer, H., Gruber, S., & Perner, J. (1985). Young children's conception of lying: Moral intuition and the denotation and connotation of "to lie." *Developmental Psychology*, *21*(6), 993–995. https://doi.org/10/d8s8nr

Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition*, *13*(1), 103–128. https://doi.org/10/cbrpxb

Xu, F., Bao, X., Fu, G., Talwar, V., & Lee, K. (2010). Lying and truth-telling in children: From concept to action. *Child Development*, *81*(2), 581–596. https://doi.org/10/bp9mdq

Yazdi, H., Heyman, G. D., & Barner, D. (2020). Children are sensitive to reputation when giving to both ingroup and outgroup members. *Journal of Experimental Child Psychology*, *194*, 104814. https://doi.org/10.31234/osf.io/q84wg

Zhao, L., Heyman, G. D., Chen, L., & Lee, K. (2018). Telling young children they have a reputation for being smart promotes cheating. *Developmental Science*, *21*(3), 12585. https://doi.org/10/gdd67r