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Optimistic expectations about communication explain children's difficulties in hiding, lying, and mistrusting liars*

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ABSTRACT

We suggest that preschoolers' frequent obliviousness to the risks and opportunities of deception comes from a trusting stance supporting verbal communication. Three studies ($N = 125$) confirm this hypothesis. Three-year-olds can hide information from others (Study 1) and they can lie (Study 2) in simple settings. Yet when one introduces the possibility of informing others in the very same settings, three-year-olds tend to be honest (Studies 1 and 2). Similarly, four-year-olds, though capable of treating assertions as false, trust deceptive informants

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(Study 3). We suggest that children's reduced sensitivity to the opportunities of lying, and to the risks of being lied to might help explain their difficulties on standard false belief tasks.

INTRODUCTION

An interest for lies and their detection is remarkably widespread across cultures (Global Deception Research Team, 2006). Moreover, vigilance towards verbal deception is a crucial ingredient of social interaction and cultural transmission: without it, our capacity to profit from linguistic communication, a major source of cultural input, would be jeopardized (Bergstrom, Moehlmann & Boyer, 2006; Sperber, 2001; Sperber *et al*., 2010). The emergence of our interest in lies and strategic deception, however, is a puzzle for students of linguistic communication. Young humans appear able to deceive quite early, possibly from their first year of life (e.g. Carlson, Moses & Hix, 1998; Evans & Lee, 2013; Lewis, Stanger & Sullivan, 1989; Talwar & Lee, 2002; Reddy, 2007). Yet, up to five years of age, children generally do not lie to opponents in simple games; they maintain their trust in deceptive informants; they consistently misinterpret simple stories of deception such as *Little Red Riding Hood* (Bradmetz & Schneider, 1999; Couillard & Woodward, 1999; Heyman, Sritanyaratana & Vanderbilt, 2013; Jaswal, Carrington Croft, Setia & Cole, 2010; Mascaro & Sperber, 2009; Peskin 1996; Sodian & Frith, 1992; Vanderbilt, Liu & Heyman, 2011).

Since its inception, research on deception has tended to interpret children's remarkable naiveté as a symptom of an inability to deceive (Stern & Stern, 1999 [1914]). Deception has two characteristics that make it cognitively challenging to produce and to detect. On the production side, to deceive requires one to manipulate other people's minds. On the reception side, full-blown vigilance towards lying requires one to refrain from accepting what others communicate, most often by treating it as false. Were children to lack either one of those two capacities, this could explain their difficulties with deception.

In this paper, we look into these two sets of abilities, and show that children possess the conceptual apparatus required to perform simple acts of deceit, and to be vigilant towards lying. What eludes them, we argue, is the recognition of opportunities to deceive. This difficulty stems from the specificities of children's social learning, in particular from a disposition to see communication as an opportunity to receive or provide genuine information. This disposition helps young children rely on communication, learn and use language, and participate in cultural transmission; it explains why interpreting games and stories of deception is so hard for them. It may also explain part of their difficulties with experiments such as standard false belief tasks.

Deception and mind-reading

Hiding is one of the simplest forms of deception. All that it involves is preventing others from accessing some piece of information. Yet even this can challenge young children. When playing hide-and-seek, for example, three-year-olds seem to miss the point of the game: they declare where they are going to hide, they do not stay hidden, they hide while the seeker is still looking (Perner, 1991; Peskin & Ardino, 2003). More complex forms of deception go beyond this: they involve implanting false beliefs in others (using language, typically). Whether children can do so before the age of four is still debated (e.g. Baillargeon, Scott & He, 2010; Perner & Roessler, 2012; Rubio-Fernández & Geurts, 2013). In fact, studies testing whether three-year-olds expect their deceptive behaviours to result in false beliefs have yielded mixed results (e.g. Carlson *et al*., 1998). Thus, many authors have stressed that before four, children's deceptions may not be motivated by an intention to create false beliefs in others. Rather, they could be reduced to one of the following explanations: wishful thinking, pleading non-guilty, joking, speaking non-literally, pretending, or applying a learned behavioural strategy (e.g. Polack & Harris, 1999; Ruffman, Olson, Ash & Keenan, 1993; Sinclair, 1996; Stern & Stern, 1999 [1914]).

Although such methodological caution is warranted, there are reasons to doubt that three-year-olds' tendency to disregard obvious deception opportunities comes from their lacking the capacity to represent others' minds. Do three-year-olds misinterpret hide-and-seek games because they cannot hide? Probably not. They have some understanding of perceptual access (Flavell, Shipstead & Croft, 1978; McGuigan & Doherty, 2002) and they use it to act on others' states of knowledge (Grosse, Scott-Phillips & Tomasello, 2013; Melis, Call & Tomasello, 2010).

Similarly, a lack of mind-reading abilities is unlikely to explain three-year-olds' relatively infrequent use of lies. In fact, the ways in which children communicate honestly in fact presupposes some capacity to manipulate the minds of others. Before their second birthday, children recognize that verbal and non-verbal communication can be used to inform others (e.g. Krehm, Onishi & Vouloumanos, 2014; Martin, Onishi & Vouloumanos, 2012; Song, Onishi, Baillargeon & Fisher, 2008; Vouloumanos, Martin & Onishi, 2014; Vouloumanos, Onishi & Pogue, 2012). They can also use pointing to fill gaps in their audience's knowledge (e.g. Liszkowski, Carpenter & Tomasello, 2007), and to correct others' false beliefs (Knudsen & Liszkowski, 2012). Honest informing requires children (i) to represent epistemic states (e.g. beliefs) that differ from their own, and (ii) to use communication in order to change those epistemic states. On the face of it, such capacities should be sufficient to support simple forms of deception.

Vigilance towards deception and representing falsity

The capacity to represent falsity may not be needed to achieve deception: in most cases, deceivers aim at convincing their victims of something that suits their strategic needs. That the thing in question is false may not matter to the deceiver. However, a sensitivity to falsity is crucial for vigilance towards deception, and for the evaluation of misleading assertions in particular. It is crucial also for realizing when one's own communicative behaviour is being deceptive and may be objected to on that ground. Current evidence regarding children's capacity to evaluate the falsity of assertions is mixed. Children have surprising difficulties treating assertions as false before five years of age. They tend to reinterpret misleading signals as if they were accurate (Bowler, Briskman, Gurvidi & Fornells-Ambrojo, 2005; Leekam, Perner, Healey & Sewell, 2008; Sabbagh, Moses & Shiverick, 2006). Three- and four-year-olds also have difficulties treating as false the testimony of an informant who is uncooperative (Heyman *et al*., 2013; Jaswal *et al*., 2010; Mascaro & Sperber, 2009; Vanderbilt *et al*., 2011), who has a false belief (Call & Tomasello, 1999), or who has been inaccurate in the past (Vanderbilt, Heyman & Liu, 2014).

Yet, children express disagreement with false assertions and correct them long before their fourth birthday (e.g. Guidetti, 2005; Koenig, Clément, and Harris, 2004; Koenig & Echols, 2003; Lyon, Quas, and Carrick, 2013; Rakoczy & Tomasello, 2009). This capacity is perhaps most evident in toddlers' use of truth-functional negation to produce and interpret denial (Austin, Theakston, Lieven & Tomasello, 2014; Choi, 1988; Hummer, Wimmer & Antes, 1993; Mascaro & Morin, 2015; Pea, 1982). Using truth-functional negation requires two things at least: (i) to represent the content of an utterance without accepting it; and (ii) to evaluate that the utterance being negated is inadequate (for example, in the case of assertions, because its meaning fails to correspond to reality). These data make it plausible that young children have sufficient capacities to evaluate an assertion as false, and to refrain from accepting it on that ground. What may challenge them, then, would be putting these capacities to actual use.

Communicative development starts with show-and-tell rather than with hide-and-seek

We propose a solution to bridge the gap between children's precocious mind-reading and epistemic competences, and their apparent naiveté towards deception. This solution draws on the view that children have difficulties translating their knowledge into successful action (e.g. Carlson *et al*., 1998; Carroll, Apperly & Riggs, 2007; Carroll, Riggs, Apperly, Graham & Geoghegan, 2012; Evans & Lee, 2013; Hala & Russell, 2001; Talwar & Lee, 2008). Intentional deception, like any other action, raises

three executive problems: recognizing action opportunities and determining which goals to achieve (the decision-making stage); establishing how to implement one's goal (the planning stage); and performing the action (the motor stage). Here, we propose that young children's problem with deception occurs at the decision-making stage: where one recognizes the opportunity to deceive and decides to seize it.

What distinguishes honest from dishonest verbal communication is not so much the sort of planning or the articulatory and other bodily resources that it may involve. Rather, it is the goal of the communicative action. Honest speakers aim at providing their audience with information that is worth processing (Sperber & Wilson, 1995). Dishonest speakers only appear to provide valuable information to their audience, when in fact they aim at manipulating them, according to their own strategic needs (Reboul, 1993; Sperber, 1994). However, both honest and dishonest communication suppose expertise (a considerable amount thereof) in planning and executing actions aimed at modifying others' mental states. Children, who appear to be proficient communicators even before they are proficient speakers, should therefore possess the planning and motor abilities required to deceive (Newton, Reddy & Bull, 2000). What they may miss is a capacity to recognize deceit opportunities. Two factors may jointly contribute to this obliviousness.

First, deceit opportunities are rarely obvious. Potential victims of deception have no interest in flaunting their vulnerability, and deceivers do not want their targets to be aware of the threat of deception. Second, opportunities to inform others may be particularly salient for young children, and this may also make opportunities to deceive less salient. The process of acquiring and practising linguistic and pragmatic skills implies the recognition of opportunities to communicate. On the production side, looking out for opportunities to inform others is part and parcel of children's communicative development. On the reception side, children's interpretation of what speakers communicate implies – at least – that speakers' meanings are worth processing, and thus constitute cases of genuine informing (Sperber & Wilson, 1995). As a result, the development of communicative skills is likely to rest on a disposition to look for opportunities to inform others and to be informed by them, a disposition which, we argue, obfuscates deceit affordances in young children.

In short, we posit that young children possess the capacities required to lie, but fail to recognize opportunities to deceive, especially when opportunities to inform others are present.

Awareness for deception and false belief tasks

A reduced awareness of deception could also play a role in explaining children's difficulties with social scenarios that revolve around misinformation: games,

stories, as well as experimental tests. It could, in particular, contribute to their difficulties with standard false belief tasks (e.g. Baron-Cohen, Leslie & Frith, 1985; Perner, Frith, Leslie & Leekam, 1989; Wimmer & Perner, 1983), which are designed to probe explicit representations of others' false beliefs (Sperber *et al*., 2010). Standard false belief tasks present many challenges that have to do with their pragmatic and linguistic structure (Hansen, 2010; Helming, Strickland & Jacob, in press; Rubio-Fernández & Geurts, 2013; Surian & Leslie, 1999; Westra & Carruthers, unpublished observations; Yazdi, German, Defeyter & Siegal, 2006). Unlike implicit tests, designed for infants who do not know that their understanding of others' beliefs is being probed (see Baillargeon *et al*., 2010, for a review), standard false belief tasks are TASKS. They involve an experimenter ostensibly providing participants with information, and probing children's understanding of it. Children need to figure out what the experimenter is after when she presents them with the task, then to look into their own mind for the piece of personal knowledge that she wants to check. This amounts to a series of reflective tasks.

Participants in standard false belief tasks have to interpret the narrative the experimenter presents them with, interpret the test question, and answer it. Each of these steps is potentially challenging for young children. To make sense of the story told by the experimenter, participants need to determine what the experimenter's intentions are in telling that story. Framing the task in certain way (for instance, calling attention to reality as opposed to the protagonist's mental states) may cause young participants to fail the task (Rubio-Fernández & Geurts, 2015). Next, when interpreting the test question, young children have to determine which piece of their knowledge the experimenter wants to check; they may fail to recognize that the experimenter wants to test their knowledge of the protagonist's false belief (Siegal & Beattie, 1991; Yazdi *et al*., 2006). When answering the test question, participants have to select an appropriate answer, a process that may be taxing for young children (e.g. Baillargeon *et al*., 2014; He, Bolz & Baillargeon, 2011; Leslie & Polizzi, 1998; Scott, He, Baillargeon & Cummins, 2012; Scott & Roby, 2015).

A heightened awareness of the possibility of deception or misinformation might help participants to overcome the challenges of being tested in a task. First, practising lies, and being vigilant towards deception, requires advanced executive abilities (Carlson *et al*.; 1998; Talwar & Lee, 2008). These capacities could contribute to better performances on a standard false belief task, for example by helping children select an appropriate answer when answering the experimenter's questions. Second, as children become more attuned to deceit opportunities, they should treat the creation and maintenance of false beliefs in others as a matter of strategic concern. This developmental change may help children interpret the

stimuli, and the test question. It should, in particular, help participants determine that the experimenter wants to test their recognition of the fact that one character is mistaken in standard false belief tasks. In line with this hypothesis, it has been shown that highlighting deceptive motives increases the odds of children being correct in standard false belief tasks (Wellman, Cross, and Watson, 2001). Note that such highlighting of deceptive motives does not reduce the demands that false belief tasks place on children's mind-reading or executive capacities. What it seems to do, rather, is highlight the relevance of tracking others' false beliefs, thus disambiguating the stimuli and the experimenter's questions.

Outline

In short, we posit that children possess the cognitive abilities necessary for deceiving and being vigilant towards deception; yet these abilities are masked by optimistic expectations. Children expect verbal communication to be reliable: that is, they believe in the dependability of others, and in the honesty that communicative contexts call for. We test this hypothesis in three studies assessing children's ability to hide, to lie, and to be vigilant towards lies. We find that three-year-olds possess the mind-reading abilities required to hide objects from others (Study 1) and to lie (Study 2). Yet, opportunities to communicate honestly pre-empt the deployment of these capacities. Study 3 indicates that four-year-olds are capable of recognizing that an assertion is false. Yet, they are trustful to the point of expecting even uncooperative agents to be honest. These results suggest that young children possess the mind-reading and epistemic abilities required for deception and vigilance towards deception. They are consistent with the hypothesis that what makes children oblivious to deception is a trusting disposition.

In all studies, sensitivity to deception correlates positively with performance on standard false belief tasks. In Studies 2 and 3, we show that these correlations cannot be explained by the development of novel abilities to represent beliefs or falsity. This result leads us to propose that, in part, children's performance on standard false belief tasks can be explained and predicted by the degree to which they are attuned to deception and misinformation.

STUDY 1: HIDING

Study 1 tested whether children possess the ability to hide an object from someone, and whether this ability is disrupted when opportunities to communicate honestly are present. To do so, children were enrolled in a simple hiding task, in which they had to choose between hiding a ball

behind a transparent barrier or behind an opaque barrier, in order to mislead a thief. In a second test, the task was modified so that hiding implied not just withholding a piece of information, but using a sign to provide the opponent with false information. In this picture hiding condition, children could hide a ball behind one of two barriers, one with a picture of the ball on it, the other painted in a plain colour. To succeed, children had to hide the ball so that the picture on the barrier would give the wrong indication regarding the location of the ball, thus rendering the ball sign misleading.

METHODS

Participants

In Study 1 and in subsequent studies, data was collected in schools of mid-sized French cities (<20000 inhabitants). Participants' parents provided informed consent. No data on the ethnic origins of children was collected. In each school, all children of the target age group whose parents gave informed consent were tested, thus explaining sample size variations across studies. In Study 1, 13 three-year-olds ($M = 3;8$, range 3;5 to 4;0) participated in the simple hiding condition. Fourteen three-year-olds ($M = 3;8$, range 3;5 to 4;0) and 20 four-year-olds ($M = 4;6$, range 4;1 to 4;10) participated in the picture hiding condition. Five children were excluded because of uncooperativeness or unresponsiveness.

Setting

In all studies, the experimenter faced the child across a small table. Children were tested in their school, in a quiet room adjacent to their classroom.

Procedure

Simple hiding condition. Children in the simple hiding condition participated in two consecutive tests: a hindering task and a helping task.

Hindering test. The child and the experimenter sat facing each other across a table. Two plastic barriers were placed equidistant from the child. One barrier was transparent, the other opaque. Whether the opaque or the transparent barrier was on the right side of the child was counterbalanced across trials. A little ball was placed in front of the child, equidistant from the two barriers. The experimenter presented a cat puppet and said: "This cat wants to steal the ball! It should not find the ball! No way!" The cat puppet was then placed below the test table, and the experimenter said (in a conspiratorial voice): "While the cat is not here, you can put the ball behind one of these barriers [E shows the locations behind the barriers], so that the cat does not find it!" The experimenter prompted the child to put the ball behind one of the barriers by saying: "Where do you put the

ball?" In case the child hid the ball in another place (e.g. in her hands, behind the table where the testing took place, in front of one of the barriers rather than behind it), the experimenter prompted the child again to select one of the two test hiding locations by repeating: "You can put the ball behind one of these barriers [E shows the locations behind the barriers], so that the cat does not find it! Where do you put the ball?" The test was repeated twice without giving children feedback on the appropriateness of their answers.

Helping test. The helping test was similar to the hindering test, except that children had to place the ball behind one of two barriers to help a puppet find it. Instead of using a cat puppet, a turtle puppet was used. Two barriers and a ball were placed in front of the child, as in the hindering test, and the child was told: "This is Franklin, the nice turtle! And that's Franklin's ball! [showing the ball to be manipulated by the child]. Franklin wants his ball back, he should find his ball!" The puppet was then removed from the scene, and the experimenter asked the test question: "Before Franklin comes back, you can put the ball behind one of these barriers so that Franklin finds the ball easily. Where do you put the ball?" The helping test was repeated twice without giving children feedback on the appropriateness of their answers.

Picture hiding condition. In the picture hiding condition, the test was introduced in exactly the same way as the hindering test of the simple hiding condition. However, two opaque barriers served as hiding locations. A picture of the ball was stuck on one. The other was simply painted in a plain colour. As in the simple hiding test, the position of the two barriers was counterbalanced across trials. Having invited the child to place the ball behind one of the two barriers, the experimenter described them. Speaking of the barrier with the picture of the ball on it, he said: "Look! When one looks at this barrier, it seems that the ball is behind it!" Speaking of the plain-coloured barrier, he said: "Look, when one looks at this barrier, it seems that nothing is behind it!" Which barrier was mentioned first was counterbalanced across trials. The child was then invited to hide the ball behind one of these barriers. Children were prompted till they hid the ball in one of these two locations. The test was repeated twice, without feedback.

Standard false belief tasks. A Smarties task (Perner *et al*., 1989) and a Sally and Ann task (Baron-Cohen *et al*., 1985) were presented to children (order of presentation counterbalanced across subjects; for children tested on the simple hiding test ($n = 13$), six children started with the Smarties task, and seven with the Sally and Ann task). For one half of the children, the false belief tasks were presented before the hiding tests; for the other half, the opposite pattern was used.

Coding and analysis. In the simple hiding condition, children scored 1 on test questions when they chose to hide the ball behind the opaque barrier, and 0 when they chose to hide it behind the transparent barrier. In the picture hiding condition, children scored 1 on test questions when they chose to hide the ball behind the barrier without a sign on it, and 0 when they chose to hide it behind the barrier that bore a sign. In Study 1 and in subsequent studies, data were coded online by the experimenter, as in previous comparable experiments (e.g. Couillard & Woodward, 1999; Flavell *et al*., 1978; Jaswal *et al*., 2010; Mascaro & Sperber, 2009; Peskin, 1992; Russell, Mauthner, Sharpe & Tidswell, 1991; Sodian, 1991; Vanderbilt *et al*., 2011). We did not find any evidence for learning effects across repeated tests in Study 1 and in subsequent studies (all ps $> \cdot 05$, McNemar tests). Thus, whenever a test was repeated for several trials, children's performances across trials were added to give a global score on which subsequent analyses were performed. All the statistics reported in this paper are two-tailed.

RESULTS

Simple hiding condition

In the hindering test, three-year-olds placed the ball behind the opaque barrier more often than predicted by chance (88% of answers, $W_+ = 55$, $W_- = 0$, $p = \cdot 002$, one-sample Wilcoxon signed rank test – henceforth, WSRT). Children's tendency to place the ball behind the opaque barrier was significantly higher in the hindering test (88% of answers) than in the corresponding helping test (38% of answers) ($W_+ = 35$, $W_- = -1$, $p = \cdot 016$, WSRT for matched pairs). Children's performances on the hindering test were also better than on standard false belief tasks (88% of correct answers vs. 8% correct answers, $W_+ = 91$, $W_- = 0$, $p < \cdot 001$, WSRT for matched pairs). To estimate children's capacity to succeed in hiding before passing standard false belief tasks, we also looked at the performance of children who failed on the two standard false belief tasks ($n = 11$; $M = 3;8$, range 3;5 to 4;0). These children still placed the ball behind the opaque barrier, above chance, in the simple hiding test (86% of answers, $W_+ = 36$, $W_- = 0$, $p = \cdot 005$, one-sample WSRT).

Picture hiding condition

In the picture hiding test, three-year-olds placed the ball behind the plain barrier less often than predicted by chance (14% of answers, $W_+ = 0$, $W_- = -55$, $p = \cdot 002$, one-sample WSRT). By contrast, four-year-olds placed the ball behind the plain barrier more often than predicted by chance (75% of answers, $W_+ = 133$, $W_- = -38$, $p = \cdot 018$, one-sample WSRT). This difference in performance between age groups was

TABLE 1. *Percentages of trials in which participants place the ball behind the opaque barrier in Study 1's simple hiding condition (comparison to chance by one-sample WSRT)*

Task	Three-year-olds
Hindering test	88% ($W_+ = 55$, $W_- = 0$, $p = \cdot002$)
Helping test	38% ($W_+ = -24$, $W_- = 35$, $p = \cdot39$)

significant (14% vs. 75% of correct answers, $U = 240$, $p = \cdot0002$, Mann–Whitney U test). Pooling data from both age groups indicated that performances on standard false belief tasks and success in placing the ball behind the plain barrier in the picture hiding game were correlated ($n = 33$, $rho = \cdot61$, $p = \cdot0002$), even after controlling for the effect of age ($n = 33$, $rho = \cdot35$, $p = \cdot049$).

DISCUSSION

Performance in the simple hiding condition suggests that three-year-olds can use the distinction between knowledge and ignorance in order to deceive others, and that they were motivated to do so in our task. However, when they had to choose between making a sign honest or rendering it dishonest (i.e. in the picture hiding condition), children's performances changed. Three-year-olds tended to favour an honest strategy, whereas four-year-olds favoured a deceptive strategy. Performances correlated with children's success on standard false belief tasks. We take three-year-olds' difficulties in the picture hiding game to be consistent with our hypothesis. Young children's deceptive capacities were overshadowed by their tendency to be honest: the possibility of using a sign to indicate the true location of the ball is enough to reverse their performance completely. Alternatively, three-year-olds may fail in the picture hiding test because of an inability to manipulate beliefs in a deceptive context. Indeed, to succeed in the picture hiding test, participants needed to use a sign to create a false belief in an opponent. Study 2 allowed us to test this possibility.

STUDY 2: LYING

Study 2 evaluated whether children can use communication to create false beliefs in others, and whether the possibility to inform others honestly may disrupt or hide this ability. Children had to lead an opponent to believe that a coin was in a box that was, in fact, empty. In the 'lies vs. truth' condition, children had to choose between telling the truth (pointing to the box containing the coin) and telling a lie (pointing to the empty box). We anticipated that this condition would be just as difficult as

TABLE 2. *Percentages of trials in which participants place the ball behind the plain barrier in Study 1's picture hiding condition (comparison to chance by one-sample WSRT)*

Task	Three-year-olds	Four-year-olds
Picture hiding	14% ($W_+ = 0$, $W_- = -55$, $p = \cdot002$)	75% ($W_+ = 133$, $W_- = -38$, $p = \cdot018$)

many comparable tests of children's deceptive abilities (Russell *et al*., 1991; Sodian, 1991), and that three-year-olds would fail it. In the other condition, the 'two lies' condition, children participated in the exact same game, but the coin was hidden in the child's hand, both boxes remaining empty. Thus, children had to choose between two lies (pointing to one of the two empty boxes). In this condition, they had no opportunity to be honest. As a result, we expected them to select the lie that best fitted their strategic aims. Alternatively, if children suffered from a general inability to plant false beliefs in others, they should be as helpless in this condition as in the first one.

METHODOLOGY

Participants

Eighteen three-year-olds ($M = 3;8$, range 3;5 to 4;0) and 18 four-year-olds ($M = 4;7$, range 4;1 to 5;2) participated.

Procedure

Deception tests. In the 'lie vs. truth' and the 'two lies' deception tasks, the child and the experimenter sat facing each other across a table, on which a cat puppet was placed at equal distance of two opaque boxes of different colours. The experimenter started by saying: "We are going to hide a coin in one of the boxes [E points to the boxes], and the cat will try to find it [E points to the cat puppet]". The experimenter then announced: "Now the cat goes away." Meanwhile, the puppet was placed below the table.

In the 'lie vs. truth' deception task, the experimenter then said in a conspiratorial tone of voice: "You know what, while the cat is away we are going to hide the coin in one of the boxes!", while putting the coin in one of the boxes, in full view of the child. The experimenter then closed the two boxes and continued: "When the cat comes back, we are going to play a good trick on him! We are going to 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]." The side of the location of the coin was counterbalanced across trials. Three test

questions followed: "Which box will you show to the cat?" (Pointing question) "The cat will believe that the coin is in which box?" (Belief question) and "Where is the coin really?" (Reality question). At the end of the trial, the cat puppet was brought back. The experimenter, using a specific tone of voice, manipulated the puppet as if it asked a question: "Where is the coin?" (Open-ended question). The task was repeated twice, without feedback on test questions.

In the 'two lies' deception task, after removing the cat puppet from the table, the experimenter said (in a conspiratorial voice): "You know what, while the cat is away we are going to hide the coin in your hand!", while showing to the child how to hide the coin in her closed fist. The rest of the trial proceeded as in the 'lie vs. truth' deception task, except that the coin was in the child's hand. When asked the pointing question ("Which box will you show to the cat?") or the belief question ("The cat will believe that the coin is in which box?"), some children showed the coin, or said the puppet would believe that the coin was in their hands. In these cases, the experimenter prompted the child again by repeating the test questions. This manipulation served to force the child to refer to one of the boxes. Conversely, when the participants were asked the open-ended question (i.e. the puppet asking: "Where is the coin?"), children were left free to point to one of the boxes or to indicate the real location of the coin. In this manner, we could probe children's use of deceptive strategies when they were left free to answer truthfully (e.g. by showing the real location of the coin). The task was repeated twice, without feedback on test questions.

False belief tasks. A Smarties task (Perner *et al*., 1989) and a Sally and Ann task (Baron-Cohen *et al*., 1985) were presented to children (order of presentation counterbalanced across subjects).

Tasks order. Tasks were presented in two orders: first the 'two lies' deception task, second the standard false belief tasks, and third the 'lie vs. truth' deception task for half of the participants; first the 'lie vs. truth' deception task, second the standard false belief tasks, and third the 'two lies' deception tasks, for the other half of the participants.

Coding. The same scoring method was employed in the 'lie vs. truth' and the 'two lies' deception tasks. For the pointing and the open-ended questions, children scored 1 when they indicated the box corresponding to the false information they were asked to give, and 0 otherwise. For the belief questions, children scored 1 when indicating that the opponent would believe the coin to be in the box they pointed at when answering the pointing question, and 0 otherwise. For the reality questions, children scored 1 when they correctly indicated the real location of the coin, and 0 otherwise.

RESULTS

Three-year-olds performed above chance level in the pointing, belief, and reality questions in the 'two lies' deception task. They performed above chance only on the reality questions in the 'lies vs. truth' deception task (see Table 3). Three-year-olds tended to perform better in the 'two lies' condition than in the 'lie vs. truth' condition on both the pointing question ($W_+ = 15$, $W_- = -63$, $p = \cdot06$, WSRT for matched pairs) and the belief question ($W_+ = 4$, $W_- = -41$, $p = \cdot03$, WSRT for matched pairs). Four-year-olds tended to succeed on the pointing, belief, and reality questions of the 'two lies' and 'lie vs. truth' deception tasks (see Table 3). To further assess whether children's success on the 'two lies' deception task was independent from passing standard false belief tasks, we pooled together three- and four-year-olds failing on the two false belief tasks ($n = 20$; $M = 3;10$, range 3;5 to 4;8). They still performed above chance level in the 'two lies' deception test on the pointing question (92% of correct answers, $W_+ = 153$, $W_- = 0$, $p < \cdot0001$), the belief question (80% of correct answers, $W_+ = 97{\cdot}5$, $W_- = -7{\cdot}5$, $p = \cdot007$), and the reality question (80% of correct answers, $W_+ = 97{\cdot}5$, $W_- = -7{\cdot}5$, $p = \cdot007$). By contrast, on the 'lie vs. truth' task, false belief tasks, failers' performances did not differ from chance on the pointing question (55% of correct answers, $W_+ = 60$, $W_- = 45$, $p = \cdot59$) and on the belief question (60% of correct answers, $W_+ = 27$, $W_- = -9$, $p = \cdot16$), although they were above chance on the reality question (90% of correct answers, $W_+ = 136$, $W_- = 0$, $p < \cdot001$).

In line with previous results (Russell *et al.*, 1991; Sodian & Frith, 1992), children's performances on standard false belief tasks correlated positively with deceptive pointing (answers to the pointing question) in the 'lie vs. truth' deception task ($rho = \cdot53$, $p < \cdot005$). Importantly, this relationship was still significant even after controlling for age and for pointing performances in the 'two lies' deception task ($rho = \cdot37$, $p = \cdot02$).

Three-year-olds' performance on the open-ended question of the 'two lies' and the 'lie vs. truth' deception tasks, which allowed them to answer their opponent's question honestly, did not differ from chance level. In fact, many three-year-olds answered the open-ended question by revealing the location of the coin – either by showing the coin or by saying (with glee) "It's in my hand!" Only by the age of four did children tend to succeed on the open-ended question, both in the 'two lies' and in the 'lie vs. truth' deception tasks (see Table 3).

DISCUSSION

Three-year-olds deceived opponents and predicted the resulting beliefs in the 'two lies' deception task, in line with evidence of precocious deceptive behaviours. Importantly, our study controls for concerns that affected

TABLE 3. *Percentages of correct answers in Study 2 (comparison to chance by one-sample WSRT)*

Test – Question	Three-year-olds	Four-year-olds
Lie vs. Truth – Pointing	61% ($W_+ = 52$, $W_- = -26$, $p = .34$)	83% ($W_+ = 119$, $W_- = -17$, $p = .006$)
Lie vs. Truth – Belief	61% ($W_+ = 67$, $W_- = -37$, $p = .36$)	81% ($W_+ = 126$, $W_- = -27$, $p = .017$)
Lie vs. Truth – Reality	89% ($W_+ = 105$, $W_- = 0$, $p = .0001$)	89% ($W_+ = 127.5$, $W_- = -8.5$, $p = .0008$)
Lie vs. Truth – Open-ended	56% ($W_+ = 76.5$, $W_- = -59.5$, $p = .67$)	72% ($W_+ = 102$, $W_- = -34$, $p = .08$)
Two lies – Pointing	86% ($W = 112$, $W_- = -8$, $p = .001$)	92% ($W_+ = 120$, $W_- = 0$, $p < .0001$)
Two lies – Belief	86% ($W = 91$, $W_- = 0$, $p = .0002$)	69% ($W_+ = 70$, $W_- = -21$, $p = .09$)
Two lies – Reality	81% ($W = 84$, $W_- = -7$, $p = .004$)	86% ($W_+ = 91$, $W_- = 0$, $p = .0002$)
Two lies – Open-ended	44% ($W_+ = 45$, $W_- = -60$, $p = .66$)	86% ($W_+ = 112$, $W_- = -8$, $p = .001$)
Standard false belief tasks	8% ($W_+ = 9$, $W_- = -144$, $p < .001$)	58% ($W_+ = 42$, $W_- = -24$, $p = .37$)

previous studies. Children's answers could not be reduced to learned strategies, pretence, jokes, non-literal uses of language, or wishful thinking. Without any feedback or training, three-year-olds (who remembered the real state of affairs) recognized that their deceptive pointing would result in a false belief.

Study 2 also pinpoints the source of children's difficulty with classic deception tasks. When children had an opportunity to be honest (in the 'lie vs. truth' deception task and in the open-ended questions after both tasks), they succeeded in lying only at age four. Thus, opportunities to communicate honestly may mask three-year-olds' competence in deceiving others. These results dovetail with studies using similar hiding games, and showing that three- to four-year-olds perform relatively well when they have to tell honestly which box they want their opponent to select (Carroll *et al.*, 2007; Samuels, Brooks & Frye, 1996). Even more surprisingly, young preschoolers also perform well when they have to indicate (honestly) to an accomplice which box she should show in order to mislead an opponent (Hala & Russell, 2001). These studies further suggest that children have the strategic abilities required to mislead others before four years of age. Our result indicates that what prevents young children from using these abilities is the pull of honesty affordances.

If children possess the mindreading abilities required to lie, how can we explain the correlation between standard false belief tasks and tests of

sensitivity to deception (e.g. Polack & Harris, 1999; Sodian & Frith, 1992; Talwar & Lee, 2008; Vanderbilt *et al*., 2011)? Here, we assume that a part of children's performance on standard false belief tasks could be accounted for by their degree of sensitivity to the risks and opportunities of lying. In line with this hypothesis, we found that there was a correlation between standard false belief tasks and lying abilities (in the 'lies vs. truth' condition), while controlling for performance on a matched task that required the use of communication to manipulate an opponent's beliefs (the 'two lies' condition).

Affordances work both ways: if three-year-olds are blinded by honesty affordances to the possibility of deceiving an opponent, they should also be blind to the fact that others may deceive them. In other words, their tendency to frame verbal and, more generally, communicative interactions as honest may explain their tendency to trust misleading information. They should, nevertheless, be fully capable of recognizing that an assertion may be false. This is what Study 3 tests.

STUDY 3: BEING VIGILANT TOWARDS LIES

In Study 3, children were presented with two tasks. The epistemic vigilance task (adapted from Mascaro & Sperber, 2009) required them to be vigilant towards deception, and to treat an assertion as false. The false communication task (adapted from Mascaro & Morin, 2015) only required them to treat an assertion as false. If children lack the executive or conceptual abilities necessary to treat communicated information as false, they should fail on both tasks. If, on the other hand, children can treat communicated information as false, but fail to recognize deceit opportunities and to react appropriately, they should succeed on the false communication task, experiencing difficulties with the epistemic vigilance task only. We tested four-year-olds – that is the approximate age when children start to display vigilance towards deception in comparable experiments (Couillard & Woodward, 1999; Heyman *et al*., 2013; Jaswal *et al*., 2010; Mascaro & Sperber, 2009; Vanderbilt *et al*., 2011).

METHODS

Participants

Forty-two four-year-olds participated (M = 4;8, range 3;10 to 5;0).

Procedure

Presentation of the hiding tasks. The epistemic vigilance task and the false communication task were presented in the same manner. The child and the experimenter sat facing each other across a table on which a puppet was

placed equidistant from two opaque boxes of different colours, with moveable lids. The experimenter first said: "We are going to play a game. I'll hide a coin [E shows the coin] in one of these boxes [E points successively to the left and right box], and you have to find it, okay?" Children were then instructed to turn away by the experimenter: "Turn while I hide the coin." While the child had her back turned away, the experimenter placed the coin in a bag below the test table, and closed the boxes. After the hiding, the child was invited to turn back: "That's it, I hid the coin!" The rest of the trial differed depending on the task, and is detailed below. For half the participants, a 'frog' puppet was used in the epistemic vigilance task, and a 'giraffe' puppet in the false communication task. The opposite pattern was used for the other half of the participants.

Epistemic vigilance task. In the epistemic vigilance task, the experimenter said: "This time, we play with the [name of the animal puppet, e.g. frog]. Be careful, the frog is very mean. It does not want you to find the coin." Prompts followed: "Is it mean? Does it want you to find the coin?" Children were always corrected if they answered prompt questions incorrectly. Then, the experimenter announced: "Now, the frog will talk to you." The puppet was made to approach one of the boxes, and patted its lid while the experimenter said (in a distinctive voice): "The coin is in the [colour of the box, e.g. red] box." The experimenter commented on this by saying (in a normal voice): "The frog says the coin is in the red box, but be careful! The frog is very mean! It does not want you to find the coin!" The experimenter then asked the test question: "So, where is the coin?" Children participated in three consecutive trials of the epistemic vigilance task, without feedback on the real location of the coin, each trial with a different pair of opaque boxes of different sizes and colours.

False communication task. The false communication task was presented in the same way as the epistemic vigilance task, except for the fact that that the puppet was not said to be 'mean'. After hiding the coin, the experimenter simply said: "This time, we play with the [name of the animal puppet, e.g. giraffe]." The experimenter then directly announced: "Now, the giraffe will talk to you." The puppet was made to indicate the location of the coin, like it did in the epistemic vigilance task. The experimenter commented on this by saying: "The giraffe says that the coin is in the [colour of the box, e.g. green] box, but be careful! That's not true!" The test question followed: "So, where is the coin?" As in the epistemic vigilance task, children received no feedback about the real location of the coin. A new pair of boxes was placed on the table, and children were invited to play again. Children participated in three consecutive trials of this task, without feedback, each trial with a different pair of opaque boxes of different sizes and colours.

False belief task. Children were presented with two Sally and Ann tasks (Baron-Cohen *et al*., 1985).

Tasks order. Children were presented with three blocks of tasks: false belief tasks, epistemic vigilance tasks, and false communication tasks. False belief tasks could be presented in first, second, or third position (counterbalanced across participants). Because we worried that children's experience with the false communication task could modify their performance in the epistemic vigilance task, false communication tasks were always presented after epistemic vigilance tasks.

Coding. In the epistemic vigilance and false communication tasks, children scored 1 on test questions when choosing the box that was not indicated by the puppet, and 0 otherwise.

RESULTS

Children's performances were above chance in the false communication task (80% of correct answers, $W_+ = 753$, $W_- = -150$, $p < .001$), but not in the epistemic vigilance task (57% of correct answers; $W_+ = 528$, $W_- = -375$, $p = .31$). Children performed better in the false communication task than in the epistemic vigilance task ($W_+ = 172$, $W_- = -18$, $p = .002$). Looking at the performance of the children who failed on the two standard false belief tasks ($n = 23$; $M = 4;5$, range 3;10 to 5;0) confirmed this pattern. False belief tasks failers performed above chance levels in the false communication task (78% of correct answers, $W_+ = 222$, $W_- = -54$, $p = .005$), but not in the epistemic vigilance task (46% of correct answers, $W_+ = 125$, $W_- = -151$, $p = .67$). They performed better on the false communication task than on the epistemic vigilance task ($W_+ = 172$, $W_- = -18$, $p = .007$). In line with previous studies (Vanderbilt *et al*., 2011), performance on false belief tasks tended to correlate with performance on the epistemic vigilance tasks, and this tendency remained even after controlling for age and performance on the false communication task ($rho = .29$, $p = .072$).

DISCUSSION

Children's capacity to pass the false communication task confirms that children possess the conceptual and executive capacities required to treat an assertion as false. Yet, despite those capacities, children maintained their trust in the malevolent informant in the epistemic vigilance task. This trust may have several possible causes: a failure to use trait attribution to predict future behaviour, difficulties in recognizing uncooperative or competitive intents, or a more specific failure to expect that uncooperative agents might communicate in a dishonest manner. Regardless of the exact source of participants' difficulty, their trust

indicates that they generally expect assertions to be reliable. Those baseline expectations were sufficiently positive to make children trust the potentially deceptive informant. These data are in line with the view that children are trusting (Heyman *et al*., 2013; Jaswal *et al*., 2010; Mascaro & Sperber, 2009; Palmquist & Jaswal, 2012; Vanderbilt *et al*., 2011). They confirm that children's lack of vigilance towards deception cannot be reduced to an inability to treat communicated information as false.

As in Study 2, we found that performance on standard false belief tasks tended to correlate with children's sensitivity to deceit opportunities (in the epistemic vigilance task), after controlling for participants' capacity to treat representations as false (in the false communication task). These findings suggest that children's performance on standard false belief tasks results in part from a heightened level of epistemic vigilance, and in particular from an increased awareness of deception opportunities, more than from the emergence of novel abilities to represent beliefs or falsity.

CONCLUSION

Children's sensitivity to deception increases during the fifth year of life. Before that age, they have a tin ear for deception, be it in simple games, in experiments, or in ecological situations. This obliviousness to deceit opportunities could be nothing but a symptom of lacking the capacity to represent beliefs or falsity, capacities that would emerge only when children come to pass standard false belief tasks. The data falsified this hypothesis. Children were able to manipulate others' perceptual access (Study 1), as well as their beliefs (Study 2), and to represent falsity (Study 3) before they could pass standard false belief tasks. Moreover, our data suggest that part of children's difficulties with deception comes from a disposition to look out for opportunities to inform and to be informed. In spite of their capacities to manipulate others' mental states, three-year-olds find it hard to deceive others when they are given an opportunity to communicate in an honest manner (in Studies 1 and 2). This disposition to frame communication as an exchange of valuable information has counterparts in children's trust. In Study 3, four-year-olds were still not fully attuned to the threat of being misled by an uncooperative informant, even though they possessed the executive and conceptual capacities to treat assertions as false.

Young humans' social environment may contribute to children's lack of awareness for deceit opportunities. In their first years of life, young children have no choice but to trust their caregivers to attend to their needs, including their informational needs. Such a stance of trust makes sense for two reasons: caregivers are generally benevolent, and they are few in number (which would make it costly if not impossible to reject input

from any one of them). This near-complete dependence makes it less beneficial for very young children to practise deception, and to be vigilant towards deception (Heyman, *et al*., 2013; Jaswal *et al*., 2010; Mascaro & Morin, 2014; Mascaro & Sperber, 2009).

Perhaps as a result of this dependency, humans, as early as their first year of life, expect communication to be an exchange of genuine information (e.g. Krehm *et al*., 2014; Vouloumanos *et al*., 2012). Before their second birthday, infants actively inform others (e.g. Liszkowski *et al*., 2007), and request information from others (Begus & Southgate, 2012; Kovács, Tauzin, Téglás, Gergely & Csibra, 2014). Situations in which one person possesses information that would be valuable to another person can be framed in various ways: as opportunities for the better informed to inform the other, or as opportunities for withholding information and taking advantage of the other. When confronted with such situations of epistemic vulnerability, children favour the first interpretation (whether they are in a position to inform or to be informed). This is arguably crucial to the development of their communicative (and in particular, linguistic) abilities. It may, however, blind them to opportunities for deception.

As children engage more and more in peer-to-peer interactions (as opposed to relationships with caregivers), they need to be more vigilant towards potential malevolence (or lack of benevolence) in others. Covert malevolence is a particularly pernicious threat to guard against. So is deceptive communication, verbal and non-verbal. On the flip side (so to speak), children steeped in peer-to-peer interactions also encounter in other children new victims for their own acts of deception – victims who are both more gullible than caregivers, and more numerous. Children's emerging sensitivity to deception is likely to help them interpret simple games of deception or tales of deceit. It also helps them to make sense of standard false belief tasks. We speculate that an increased intuitive awareness of misinformation, both of its possibility and of its strategic importance, could contribute to the emergence of a reflective interest for others' minds. Such explicit theorizing is likely to be distinct from the early-emerging, intuitive mechanisms that allow infants to interpret others' behaviours. It may thus participate in the development of an explicit ('folk') theory of mind.

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