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# What do you really think? Children's ability to infer others' desires when emotional expressions change between social and nonsocial contexts

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## Abstract

We investigate children's ability to use social display rules to infer agents' otherwise under-determined desires. In Experiment 1, seven-to-ten-year-olds saw a protagonist express one emotional reaction to an event in front of her social partner (the Social Context), and a different expression behind her social partner's back (the Nonsocial Context). Children were able to use the expression in the Social Context to infer the social partner's desire and the expression in the Nonsocial Context to infer the protagonist's desire. This ability increased between ages seven and ten (Experiment 1). When task demands were reduced (Experiment 2), seven-to-eight-year-olds, but not five-to-six-year-olds, succeeded. These results suggest that although it is not easy for observers to infer emotions masked by social display rules, changing emotional expressions between social and non-social contexts allow even children to recover not only the desire of the person displaying the emotions, but also that of the audience.

**Keywords:** emotional expression; social display rule; mental state inference

## Introduction

Young children can use emotional expressions to draw inferences about both external events in the world (e.g., Berman, Chambers, & Graham, 2010; Feinman, Roberts, Hsieh, Sawyer, & Swanson, 1992; Wu, Muentener, & Schulz, 2015), and others' internal mental states (e.g., Repacholi & Gopnik, 1997; Rieffe, Terwogt, & Cowan, 2005; Wellman, Phillips & Rodriguez, 2000; Wu & Schulz, 2017). However, because people sometimes go to great lengths to disguise their true feelings, emotional expressions can be misleading. When speaking in front of a large audience, an adult will pretend to be calm, even if she is nervous. When receiving an undesirable gift, a polite child will pretend to be happy even if she is disappointed. As we will review, a relatively large body of work has looked at children's understanding of social display rules and masked emotions. Here however, we consider a feature of social display rules that has been largely overlooked in prior work: they may disguise an individual's feelings while being informative about the feelings of her social partner's. When someone congratulates a friend in public but fumes in private, we learn not only that this person's true feelings about the event are negative, but also that her friend's true feelings are probably positive. Thus, masked emotions may reveal (about social partner's) as much as they conceal (about the individual herself). Given evidence about someone's feelings in both social and non-social contexts, an observer might therefore recover information both about

the individual's mental states, and those of the society she keeps.

This kind of inference is non-trivial: it requires tracking someone's emotional expressions across social and non-social contexts, reasoning recursively about the mental states of at least two parties. To our knowledge, despite abundant work on emotion understanding and theory of mind in early childhood (see Wellman, 2014 for review), no one has yet looked at whether children can use real and apparent emotions to infer not only the true feelings of the person expressing the emotions but also of their intended audience. That is our goal here.

First however, we note that there is a long line of work on children's ability to understand others' real and apparent emotions and their ability to respect display rules in their own behavior. Research suggests that young children modulate both their verbal and nonverbal responses in social contexts (Cole, 1986; Saarni, 1984; Talwar & Lee, 2002; Talwar, Murphy, & Lee, 2007; Xu, Bao, Fu, Talwar, & Lee, 2010). If for instance, an experimenter has lipstick on her nose and asks a child how she looks, children as young as three lie and tell her that she looks okay (Talwar & Lee, 2002). By three and four, children (in the laboratory anyhow) inhibit their negative emotional responses to an undesirable gift in front of a gift giver (Cole, 1986). As children get older, they are more likely to lie for pro-social purposes than for self-protective purposes (Xu, Bao, Fu, Talwar, & Lee, 2010), and some evidence suggests that girls are better than boys at regulating their verbal and nonverbal behaviors (Cole, 1986; Davis, 1995; Saarni, 1984).

Between ages three and ten, children also show an increasing ability to understand others' masked emotions in social contexts. When predicting a recipient's response to an undesirable gift, children invoke both verbal display rules (e.g., judging that the recipient will tell a white lie) and facial display rules (e.g., judging that she will express happiness rather than disappointment; Broomfield, Robinson, & Robinson, 2002; see also Gnepp & Hess, 1986). Children appear to understand verbal display rules earlier than facial display rules (Broomfield, Robinson, & Robinson, 2002), and are better at understanding display rules for pro-social purposes than for self-protective purposes (Gnepp & Hess, 1986; but see Misailidi, 2006). The latter may be influenced by family emotional climates. For example, negative expressiveness in a family environment correlates positively with children's understanding of self-protective display rules and negatively with their understanding of pro-social display rules (Jones, Abbey, & Cumberland, 1998). Additionally, some

researchers (Banerjee, 2002; Banerjee & Yuill, 1999a, 1999b; Naito & Seki, 2009) argue that the understanding of social display rules relies on an ability to represent second-order mental state information. In support of this, children's performance on a second-order false belief task predicts their understanding of self-protective display rules (Banerjee & Yuill, 1999b) and a more recent study suggests that it predicts both their understanding of self-protective and pro-social display rules (Naito & Seki, 2009).

Although fruitful, much of this literature has used tasks with very rich contextual information (Banerjee, 1997; Harris, Donnelly, Guz, Pitt-Watson, 1986; Misailidi, 2006; Josephs, 1994; Wellman & Liu, 2004; Naito & Seki, 2009; Gross & Harris, 1988). This is especially true for studies involving very young children. For example, in Banerjee's study (1997), preschoolers were read stories including an eliciting event (e.g., "Michelle is sleeping over at her cousin's house but she forgot her favorite teddy bear at home"), an agent's mental state (i.e., "Michelle is really sad that she forgot her teddy bear"), an intention to hide the agent's true feeling (i.e., "Michelle doesn't want her cousin to see how sad she is"), and a reason for hiding that feeling (i.e., "because her cousin will call her a baby"). Children were then asked about what the agent really feels and what she will try to look on her face. In such contexts, children may succeed without going much beyond the information available in the stories.

Consistent with this concern, studies using less informative contexts have found that an understanding of masked emotion and social display rules emerges much later in development (Broomfield, Robinson, & Robinson, 2002; Gnepp & Hess, 1986; Jones, Abbey, & Cumberland, 1998). For instance, Gnepp & Hess (1986) provided children (first, third, fifth, and tenth graders) with an eliciting event and an agent's mental state but did not explicitly mention the agent's intention to hide her feelings or any reason for her doing so. Children failed to predict the use of verbal display rules until third grade. Even adolescents (who successfully predicted the use of verbal display rules) frequently failed to predict that the agents would try to regulate their facial expressions. However, with less information in the stories, there is more uncertainty about whether the protagonist intended to be polite or not; children may have preferred to predict the emotional expression that directly mapped onto the protagonist's true mental state.

Thus, there remains some ambiguity about what children understand, and when, about masked emotions. Rich detailed scenarios may overestimate children's ability to understand social display rules, while less informative scenarios may be open to interpretations that do not involve social display rules at all.

More critically for the present purposes, previous work does not ask whether children can recover information, not only about the person displaying the emotion, but also about the person who is the intended audience of the emotion. To test this, we introduce children to a simple context where one of two teams wins a game. An observer of the game

displays one of two emotional reactions (happy or sad) in front of a social partner and the contrasting emotional expression (sad or happy) behind the social partner's back. We ask children both the desire of the person expressing the emotion, and that of his social partner. Since abundant work suggests that even infants and toddlers understand that someone whose desires are fulfilled will be happy and that someone whose desires are thwarted will be sad (see e.g., Skerry & Spelke, 2014; Stein & Levine, 1989; Wellman & Woolley, 1990; Yuill, 1984), we took it for granted that by middle childhood, children could make this inference. The critical question was whether children could recover each participant's true desires given that one person (henceforth the Protagonist) displayed contradictory emotions in the social and non-social contexts, and the other person (henceforth the Social Partner) never displayed any emotion at all. (Not only do children not see the social partner's face, they have no other source of information about his emotions or desires. Thus the only way they can infer the social partner's desires is by using the protagonist's display of a false, misleading emotion in his presence. Given that without considerable scaffolding, children only appear to understand masked emotion relatively late in development (e.g., Broomfield et al., 2002; Gnepp & Hess, 1986; Jones et al., 1998), in Experiment 1 we test seven- to ten-year-olds. In Experiment 2, we reduce the task demands and test five- to eight-year-olds. In both cases, we look at whether children can use the emotional expression in the nonsocial context to infer the protagonist's desire and the emotional expression in the social context to infer the social partner's desire.

## Experiment 1

### Method

**Participants** Thirty-two children ( $M = 8.8$  years; range: 7.2-10.8; 56% girls) were recruited from an urban children's museum. To ensure a balanced distribution across ages, children were recruited in age bins consisting of 16 seven- and eight-year-olds ( $M = 7.9$  years; range: 7.2-8.8; 63% girls) and 16 nine- and ten-year-olds ( $M = 9.8$  years; range: 9.0-10.8; 50% girls). While most of the children were white and middle class, a range of ethnicities and socioeconomic backgrounds reflecting the diversity of the local population (47% European American, 24% African American, 9% Asian, 17% Latino, 4% two or more races) and the museum population (29% of museum attendees receive free or discounted admission) were represented throughout.

**Materials** Each child saw two illustrated stories, one presenting the Happy-Sad condition (e.g., Tom was happy in front of Bryan but sad behind Bryan's back) and the other presenting the Sad-Happy condition. The facial expressions were from istock photos (<http://www.istockphoto.com/>) and have been used by previous research (Wu & Schulz, 2017). The mapping between stories and conditions, and the order of conditions were counterbalanced across participants, resulting in a total of 4 storybooks. Different agents and

games were used in each storybook (Tom, Bryan, and basketball in one story and Sally, Diana, and volleyball in the other).

**Procedure** Children were tested individually; all sessions were videotaped. Children were asked check questions to encourage them to follow along. Incorrect responses were corrected throughout. Children had little difficulty with the check questions. Check questions were used only to maintain children’s attention; they were not analyzed or used as inclusion criteria.

Each story was read consecutively, as follows (using the basketball-game story as an example). The experimenter placed the first picture on the table and said, “There is a basketball game today. It’s the Tiger team against the Lion team.” She introduced the next picture and said, “This is Tom. Tom is a basketball fan. He loves watching basketball games. He goes to watch the game. He is either a fan of the Tiger team, or the Lion team, but we don’t know which one.” Children were asked (Check question 1): “Do we know which team Tom is a fan of?” The experimenter introduced the third picture and said, “This is Bryan. Bryan was Tom’s friend when they were little, but now they don’t get to see each other very much. Bryan becomes a basketball player. He plays in the game. He either plays for the Tiger team or the Lion team, but we don’t know which one.” Children were asked (Check question 2): “Do we know which team Bryan plays for?” The experimenter introduced the fourth picture and said, “The result of the game was that the Tiger team won, and the Lion team lost.” Then the experimenter introduced the fifth picture and said, “After the game, Bryan ran back to the locker room. Tom was passing by and saw Bryan. It was a very noisy and crowded room and they didn’t have a chance to talk. However, in front of Bryan, when Tom came passing by, Tom made a face like this.” Children were asked (Check question 3): “Did Tom look happy or sad?” The experimenter introduced the sixth picture and said, “However, behind Bryan’s back, as soon as Bryan passed by and couldn’t see Tom, Tom made another face.” Children were asked (Check question 4): “Did Tom look happy or sad?” We controlled for the complexity between the social and nonsocial contexts by having two people in both contexts; the difference was only that in the social context, they were facing towards each other, and in the nonsocial context, they were facing away from each other. (See Figure 1.)

Finally, the experimenter asked two test questions. The first question was about the protagonist (Protagonist Question): “Now I am going to ask you some questions. In front of Bryan, Tom looked [happy/sad] but behind Bryan’s back, Tom looked [sad/happy]. Do you think Tom is a fan of the Tiger team or Lion team?” The experimenter then asked the other test question (Social Partner Question): “Does Bryan play for the Tiger team or the Lion team?”<sup>1</sup>

<sup>1</sup> These two questions, although indirect assays of the agents’ desires, were selected as being more natural to the context. To

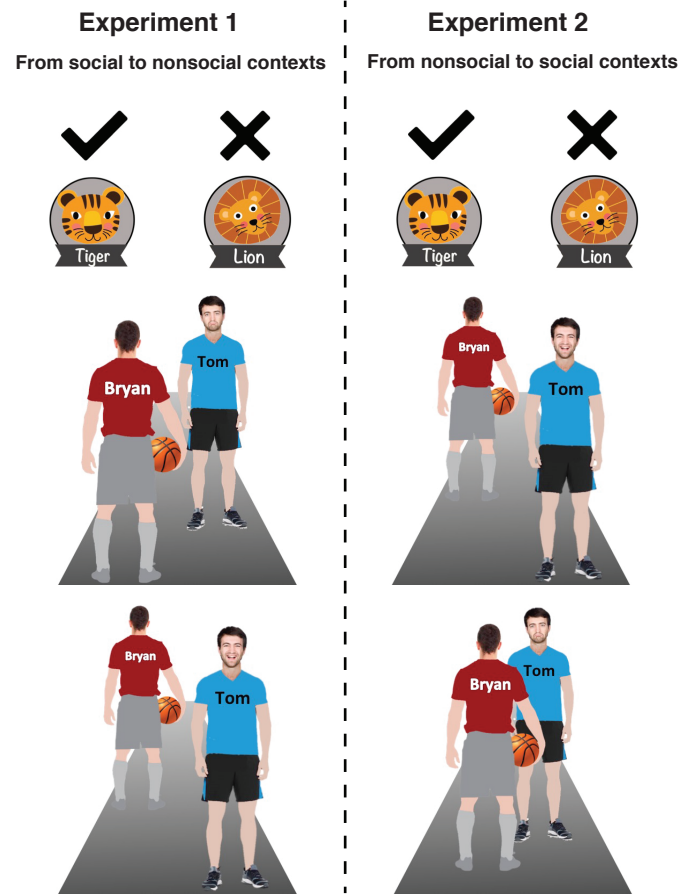


Figure 1 Example of the materials used in Experiments 1 and 2 (corresponding to the fourth to sixth pictures described in Procedure).

**Coding** We scored children’s responses separately for the Protagonist and the Social Partner. Children received one point for answering a question correctly and none for answering it incorrectly.

### Results and discussion

Participants performed equally well in the Happy-Sad and Sad-Happy conditions (protagonist:  $X^2 = .59, p = .442$ ; social partner:  $X^2 = .00, p = 1.00$ ). Additionally, there was no order effect between the first and second stories (protagonist:  $X^2 = .07, p = .798$ ; social partner:  $X^2 = .00, p = 1.00$ ). Thus, we collapsed children’s scores across the two conditions. This resulted in a score of 0-2 for the Protagonist and a score of 0-2 for the Social Partner.

Using age as a continuous variable, we found that children between ages seven and ten showed an increasing ability to use the emotional expression in the nonsocial context to reason about the protagonist’s desire ( $\beta = .75, SE = .36, z = 2.11, p = 0.035$ ; Ordinal Logistic Regression), and the emotional expression in the social context to recover the

answer these two questions, however, children have to infer the two agents’ desires.

social partner's desire ( $\beta = .69$ ,  $SE = .34$ ,  $z = 2.02$ ,  $p = 0.044$ ). See Figure 2.

Overall, children did not recover the protagonist's desire above chance ( $z = 1.40$ ,  $p = .230$ ) and showed a non-significant trend towards recovering the social partner's desire ( $z = 2.13$ ,  $p = .052$ ) but there was no significant difference between the two ( $z = -1.13$ ,  $p = .453$ ). Because of the age effect, we did a median split on age. Seven- and eight-year-olds did not perform above chance on either question (protagonist:  $z = -.58$ ,  $p = .774$ ; social partner:  $z = .00$ ,  $p = 1.00$ ); however, nine- and ten-year-olds performed above chance on both (protagonist:  $z = 2.50$ ,  $p = .022$ ; social partner:  $z = 2.67$ ,  $p = .013$ ). See Figure 2.

These results suggest that nine- and ten-year-olds can use changing emotional expressions between social and nonsocial contexts to recover the desires of both the protagonist and the social partner in a masked emotion context. However, why did younger children fail? As noted, many previous studies suggest that by seven and eight, children can predict an agent's real and apparent emotions given relatively rich contextual information (Banerjee, 1997; Harris, Donnelly, Guz, Pitt-Watson, 1986; Misailidi, 2006; Josephs, 1994; Wellman & Liu, 2004; Naito & Seki, 2009; Gross & Harris, 1988; Gnepp & Hess, 1986; Broomfield, Robinson, & Robinson, 2002; Jones, Abbey, & Cumberland, 1998). They can also represent second-order mental state information (Perner & Wimmer, 1985; Sullivan, Zaitchik, & Tager-Flusberg, 1994), which supports the understanding of social display rules. Thus, it is possible that children's chance performance here was due to task demands. In particular, children may have tripped up by the fact that the first expression they saw was an apparent, misleading emotional expression. Only when children saw the second expression, did they have the information to tell that the first expression was a fake one.

In the next experiment, we reduce these task demands by flipping the order of the social and nonsocial contexts. Thus, children first see the agent's emotional expression in the nonsocial context and then a different one in the social context. This order does not require children to re-interpret the first emotional expression; additionally, the first expression may provide a basis for children to understand the expression displayed in the social context. To see if even younger children might succeed given these reduced task demands, we test both seven- and eight-year-olds and five- and six-year-olds.

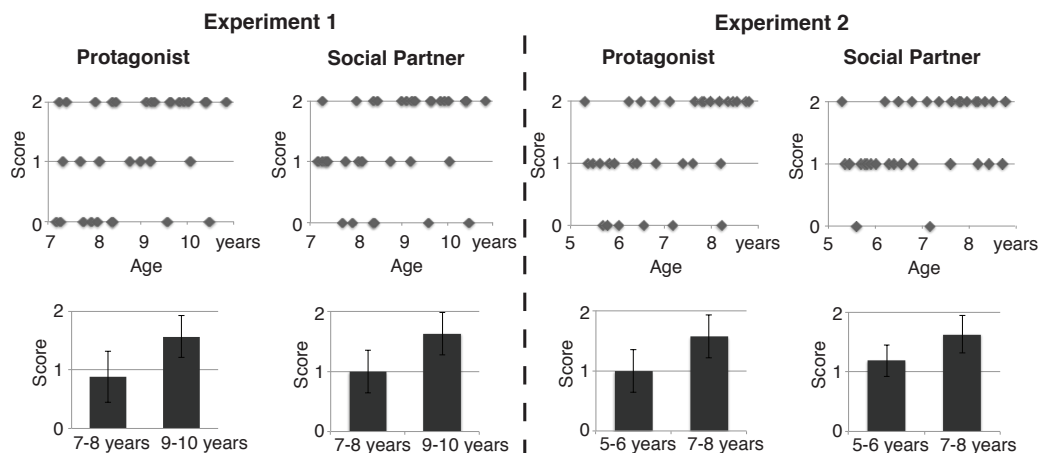


Figure 2 Results of Experiments 1 and 2. The top row shows individual children's performance on the questions about each agent, collapsing across the Happy-Sad and Sad-Happy conditions. The bottom row shows children's performance by age bin. Error bars indicate 95% confidence intervals.

## Experiment 2

### Method

**Participants** Thirty-two children ( $M = 7.0$  years; range: 5.3-8.8; 66% girls) were recruited from the children's museum. Half of them were seven- and eight-year-olds ( $n = 16$ ;  $M = 8.0$  years; range: 7.1-8.8; 75% girls) and the other half were five- and six-year-olds ( $n = 16$ ;  $M = 6.0$  years; range: 5.3-6.8; 56% girls).

**Materials, procedure and coding** The materials, procedure and coding were identical to Experiment 1 except that we flipped the order of the social and nonsocial contexts. See Figure 1. For example, instead of first showing Tom's emotional expression in front of Bryan, the experimenter presented Tom's expression behind Bryan's back: "After the game, Tom made a face like this. At this moment, Bryan was nearby but Tom didn't see him." Children were asked a check question: "Did Tom look happy or sad?" The experimenter then introduced the next picture and said, "However, Tom turned around and saw Bryan. Tom made another face." Children were asked another check question: "Did Tom look happy or sad?"

### Results and discussion

As in Experiment 1, participants performed equally well in the Happy-Sad and Sad-Happy conditions (protagonist:  $X^2 = 2.82$ ,  $p = .093$ ; social partner:  $X^2 = .67$ ,  $p = .412$ ). There was no order effect between the first and second stories (protagonist:  $X^2 = .93$ ,  $p = .335$ ; social partner:  $X^2 = .67$ ,  $p = .412$ ). Thus, children's scores were collapsed across the two conditions.

We used the same analyses as in Experiment 1. Taking age as a continuous variable, we found that children between ages five and eight showed an increasing ability to recover both the protagonist's ( $\beta = .89$ ,  $SE = .35$ ,  $z = 2.53$ ,  $p = .011$ ) and the social partner's desires ( $\beta = .81$ ,  $SE = .36$ ,  $z = 2.25$ ,  $p = 0.024$ ). See Figure 2.

Overall, there was a non-significant trend for children to recover the protagonist's desire ( $z = 1.96, p = .078$ ) and children successfully recovered the social partner's desire ( $z = 3.15, p = .002$ ); there was no significant difference between the two ( $z = -1.13, p = .453$ ). Given the age effect, we performed a planned median split on age. Five- and six-year-olds did not perform above chance in either question (protagonist:  $z = .00, p = 1.00$ ; social partner:  $z = 1.34, p = .375$ ) but seven- and eight-year-olds succeeded in both (protagonist:  $z = 2.50, p = .022$ ; social partner:  $z = 2.89, p = .006$ ). See Figure 2. Thus, we found that at least by ages seven and eight, children can use changing emotional expressions between social and nonsocial contexts to recover the desires of both participants in a social exchange, even when one participant is masking her emotions and the only cue to the other participant's desires is that misleading, masked emotional reaction.

## General Discussion

In two experiments, we investigated children's ability to use the information embedded in social display rules to recover others' otherwise under-determined mental states. Children saw an emotional expression when a protagonist was in front of a social partner, and a different expression when the protagonist was behind the social partner's back. Children successfully used the expression in the nonsocial context to infer the protagonist's desire, and the expression in the social context to infer the social partner's desire. Children's ability to draw these inferences improved between ages five and eight.

Our study builds on many previous studies that have looked at children's ability to predict an agent's real and apparent emotions given rich mental state information (e.g., the agent's desires, true feelings, her intentions, and a motivation to hide her true feelings; Banerjee, 1997; Harris, Donnelly, Guz, Pitt-Watson, 1986; Misailidi, 2006; Josephs, 1994; Wellman & Liu, 2004; Naito & Seki, 2009; Gross & Harris, 1988; Gnepp & Hess, 1986; Broomfield, Robinson, & Robinson, 2002; Jones, Abbey, & Cumberland, 1998). In contrast, here we provided children with very minimal background information, and no direct information about the agent's mental states. Children's ability to use the social context to recover the desires of an agent who provided two contradictory emotional reactions to an event, and also the desire of a social partner, whose emotional expressions were never observed at all, is consistent with other studies finding that children can recover rich unobserved information from observed emotional cues (e.g., Berman, Chambers, & Graham, 2010; Feinman, Roberts, Hsieh, Sawyer, & Swanson, 1992; Wu, Muentener, & Schulz, 2015; Repacholi & Gopnik, 1997; Rieffe, Terwogt, & Cowan, 2005; Wellman, Philips & Rodriguez, 2000; Wu & Schulz, 2017). However, our study goes beyond those studies in suggesting that children can also detect and understand the conditions in which real emotions are masked.

Although emotional expressions are misleading when people mask their true feelings, our results indicate that the

masking behavior itself (if detected) can be richly informative. Note that feigning an emotional expression in front of others reflects one's beliefs and desires about others' beliefs or desires. Thus when a feigned emotional expression is detected, it contains recursive mental state information about what one agent thinks about what another agent thinks. Although there has been debate on the extent to which reasoning about pro-social display rules requires second-order mental state representation (Banerjee, 2002; Banerjee & Yuill, 1999a, 1999b; Naito & Seki, 2009), in our task, the social partner's beliefs, desires, and emotions were unknown throughout. To recover information about the social partner, children had to refer to the protagonist and selectively use the protagonist's emotional expressions to gain insight into the mind of his audience. We suggest that this kind of inference does require recursive mental state reasoning, and the current results suggest that the ability to make these inferences develops over middle childhood.

Critically, children succeeded here in a very tightly constrained context: there were only two possible outcomes (one of two teams won a game), two possible emotional responses (happy or sad) and two social partners. Moreover, the task design virtually eliminated any memory demands: children did not need to track the changing emotional expressions over time; they were all concurrently displayed in the storybook card format, together with the social context. Future work might look at children's ability to draw comparable inferences when they must track changing emotional dynamics over time and in more complex, multi-participant scenarios. Note however, that although more realistic scenarios may add processing demands and complexity, they may also provide children with richer cues to agents' mental states.

The current results however, suggest that by age seven, children can recover underlying mental states from changes between real and apparent emotional expressions. Intriguingly, the current results also suggest that there is a limit to how much we can hide when we hide our feelings: in disguising our true feelings, we may reveal what we think about what other people want.

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